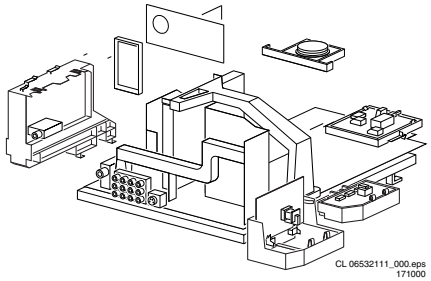
EM1A

AA

Service
Service
Service



Service Manual

Contents			Page	
1.	Technical specifications, connection facilities & chassis overview		2	
2.	Safety- and maintenance instructions, warnings and notes.		4	
3.	Directions for use		6	
4.	Mechanical instructions		11	
5.	Faultfinding and repair tips		15	
6.	*Block-, wiring diagrams and testpoint overviews*			
	Blockdiagram video processing		27	
	Blockdiagram audio & control		28	
	Blockdiagram Large Signal Panel: supply		29	
	Powerlines overview		30	
	Wiring diagram		31	
	I^2C overview		32	
	Testpoint overview LSP		33	
	Testpoint overview SSB / DW / CRT panel		34	
7.	*Electrical diagram's en PWB's*		*Diagram*	*PWB*
	Main supply	(Diagram A1)	35	43-48
	Standby supply	(Diagram A2)	36	43-48
	Line deflection	(Diagram A3)	37	43-48
	Frame deflection	(Diagram A4)	38	43-48
	Audio amplifier	(Diagram A5)	39	43-48
	Headphone amplifier	(Diagram A6)	40	43-48
	Tuner, I/O, SIMM-connector	(Diagram A7)	41	43-48
	Front control	(Diagram A8)	42	43-48
	SSB: SIMM-connector	(Diagram B1)	49	55-60
	IF, I/O, videoprocessing	(Diagram B2)	50	55-60
	Feature box	(Diagram B3)	51	55-60
	HOP	(Diagram B4)	52	55-60
	Audio demodulator	(Diagram B6)	53	55-60
	Painter	(Diagram B7)	54	55-60
	Multi PIP controller	(Diagram C1)	61	65/66
	Tuner	(Diagram C2)	62	65/66
	I/O processing	(Diagram C3)	63	65/66

Contents			Page	
	IF video sync	(Diagram C4)	64	65/66
	Side I/O panel	(Diagram D)	67	67
	Top control panel	(Diagram E)	69	69
	CRT panel	(Diagram F)	70	71
	DC-shift panel	(Diagram G)	71	71
	Horizontal DAF panel	(Diagram I1)	72	74
	Vertical DAF panel	(Diagram I2)	73	74
	Mains switch panel	(Diagram J)	75	75
	Mains harmonic panel	(Diagram Y)	76	76
8.	Alignments		77	
9.	Circuit description and list of abbreviations		82 96	
10.	Spareparts list		98	

©Copyright 2000 Philips Consumer Electronics B.V. Eindhoven, The Netherlands.
All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, or otherwise without the prior permission of Philips.

Published by CO 0070 Service PaCE | Printed in the Netherlands | Subject to modification | GB 3122 785 10850

PHILIPS

1. Technical specifications, connection facilities & chassis overview

1.1 Technical specifications

1.1.1 Reception

Tuning system	:	PLL
Colour systems (off-air)	:	NTSC M (3.58 & 4.43 MHz),
	:	PAL B/G/D/K/I/M/N,
	:	SECAM B/G/D/K/L
Sound systems	:	FM/FM,
	:	2SC B/G,
	:	NICAM B/G/D/K/I/L
A/V connections	:	PAL B/G,
	:	SECAM,
	:	NTSC M (3.58 & 4.43 MHz).
Channel selections	:	100 channels,
	:	UVSH-channels
Frequency range	:	44.25 - 855.25 MHz
Aerial input	:	75 Ω, Coax

1.1.2 Miscellaneous

Set stroke numbers	:	/56, /57, /69, /79, /93
Mains voltage	:	160 - 276 V (± 10 %),
	:	50 / 60 Hz (± 5 %)
Ambient temperature	:	+ 5 to + 45 deg. C.
Standby Power consumption	:	< 1 W.

1.2 Connection facilities

1.2.1 Control buttons & Side I/O connections

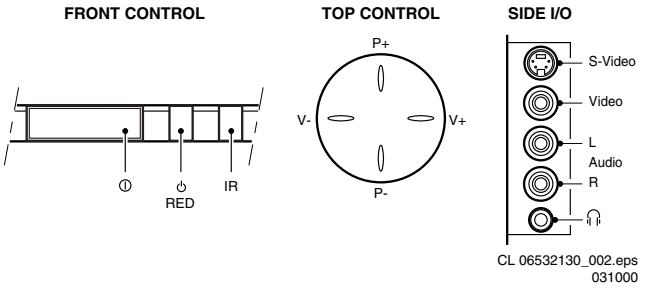


Figure 1-1

SVHS

1 -	gnd	⊥
2 -	gnd	⊥
3 - Y	1 Vpp / 75 Ω	⊖
4 - C	0.3 Vpp / 75 Ω	⊖

Audio / video

1 - Video	1 Vpp / 75 Ω	⊖◎
2 - Audio	L (0.2 Vrms / 10 kΩ)	⊖◎
3 - Audio	R (0.2 Vrms / 10 kΩ)	⊖◎
4 - Headphone	32 - 2000 Ω / 10 mW	◎/🎧

1.2.2 Rear connections

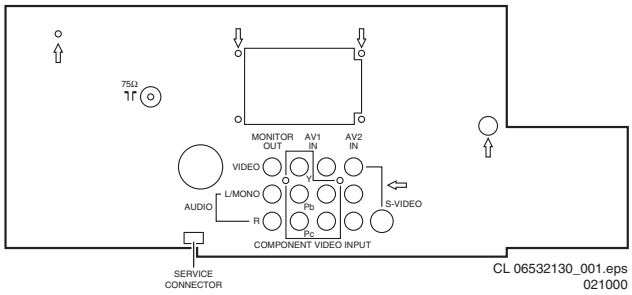


Figure 1-2

Monitor out

1 - Video	1 Vpp / 75 Ω	⊖◎
2 - Audio	L (0.5 Vrms / 10 kΩ)	⊖◎
3 - Audio	R (0.5 Vrms / 10 kΩ)	◎

AV1 in

1 - Y	0.7 Vpp / 75 Ω	⊖◎
2 - Pb	0.7 Vpp / 75 Ω	⊖◎
3 - Pr	0.7 Vpp / 75 Ω	⊖◎

AV1 in

4 - Video	1 Vpp / 75 Ω	⊖◎
5 - Audio	L (0.5 Vrms / 10 kΩ)	⊖◎
6 - Audio	R (0.5 Vrms / 10 kΩ)	⊖◎

AV2 in

1 - Video	1 Vpp / 75 Ω	⊖◎
2 - Audio	L (0.5 Vrms / 10 kΩ)	⊖◎
3 - Audio	R (0.5 Vrms / 10 kΩ)	⊖◎

AV2 in (SVHS)

1 -	gnd	⊥
2 -	gnd	⊥
3 - Y	1 Vpp / 75 Ω	⊖
4 - C	0.3 Vpp / 75 Ω	⊖

1.3 Chassis overview

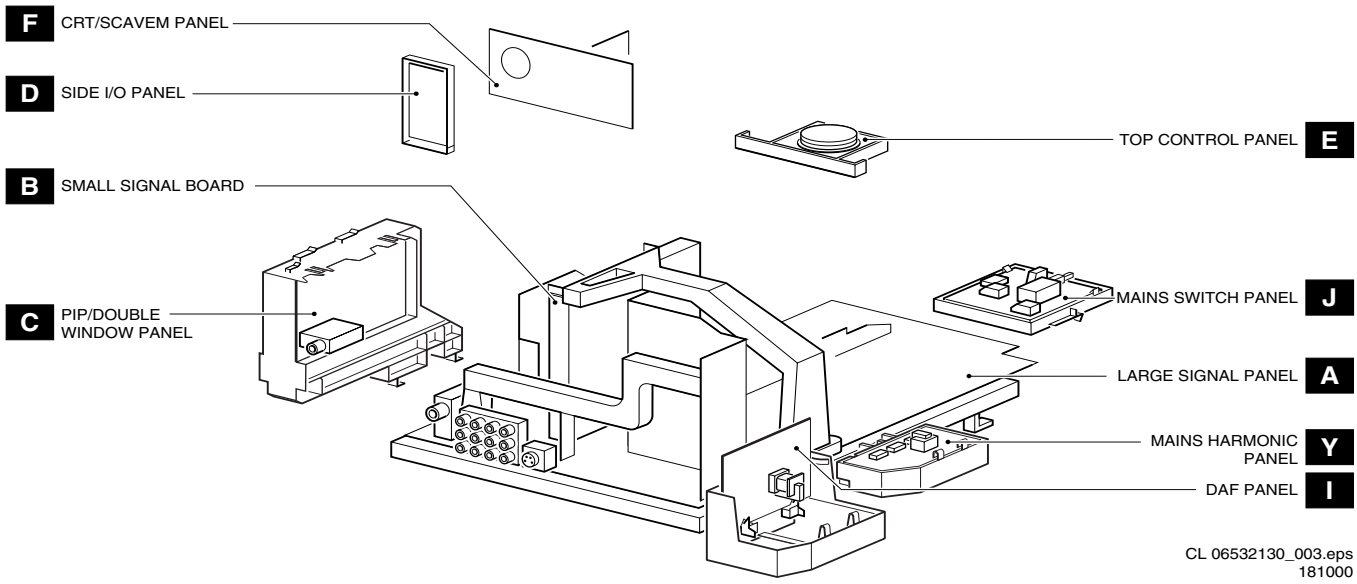


Figure 1-3

2. Safety & maintenance instructions, warnings and notes

2.1 Safety instructions for repairs

Safety regulations require that during a repair:
- Safety components, indicated by the symbol Δ, should be replaced by components identical to the original ones;
- When replacing the CRT, safety goggles must be worn.

Safety regulations require that after a repair, the set must be returned in its original condition. In particular attention should be paid to the following points:
- General repair instruction: as a strict precaution, we advise you to resolder the solder joints, through which the horizontal deflection current is flowing, in particular:
  - All pins of the line output transformer (LOT);
  - Fly-back capacitor(s);
  - S-correction capacitor(s);
  - Line output transistor;
  - Pins of the connector with wires to the deflection coil;
  - Other components through which the deflection current flows.

Note: This resoldering is advised to prevent bad connections due to metal fatigue in solder joints and is therefore only necessary for television sets older than 2 years.
- The wire trees and EHT cable should be routed correctly and fixed with the mounted cable clamps.
- The insulation of the mains lead should be checked for external damage.
- The mains lead strain relief should be checked for its function in order to avoid touching the CRT, hot components or heat sinks.
- The electrical DC resistance between the mains plug and the secondary side should be checked (only for sets which have a mains isolated power supply). This check can be done as follows:
  - Unplug the mains cord and connect a wire between the two pins of the mains plug;
  - Set the mains switch to the 'ON' position (keep the mains cord unplugged!);
  - Measure the resistance value between the pins of the mains plug and the metal shielding of the tuner or the aerial connection on the set. The reading should be between 4.5 MΩ and 12 MΩ.
  - Switch off the TV and remove the wire between the two pins of the mains plug.
- The cabinet should be checked for defects to avoid touching of any inner parts by the customer.

2.2 Maintenance instructions

It is recommended to have a maintenance inspection carried out by a qualified service employee. The interval depends on the usage conditions:
- When the set is used under normal circumstances, for example in a living room, the recommended interval is 3 to 5 years.
- When the set is used in circumstances with higher dust, grease or moisture levels, for example in a kitchen, the recommended interval is 1 year.
- The maintenance inspection contains the following actions:
  - Execute the above-mentioned 'general repair instruction'.
  - Clean the power supply and deflection circuitry on the chassis.
  - Clean the picture tube panel and the neck of the picture tube.

2.3 Warnings

- In order to prevent damage to IC's and transistors, all high-voltage flashovers must be avoided. In order to prevent damage to the picture tube, the method shown in Fig. 2-1 should be used to discharge the picture tube. Use a high-voltage probe and a multimeter (position VDC). Discharge until the meter reading is 0 V (after approx. 30 s).

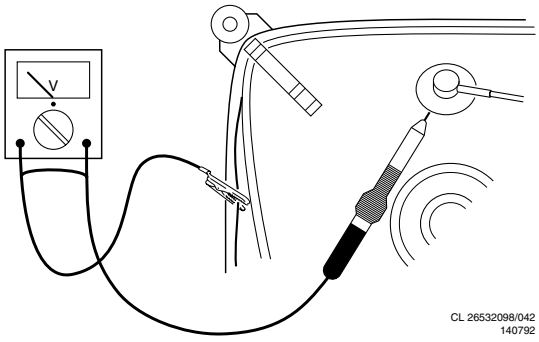


Figure 2-1

- All IC's and many other semiconductors are susceptible to electrostatic discharges (ESD). Careless handling during repair can reduce life drastically. When repairing, make sure that you are connected with the same potential as the mass of the set by a wristband with resistance. Keep components and tools also at this same potential. Available ESD protection equipment:
  - Complete kit ESD3 (small table mat, wristband, connection box, extension cable and earth cable) 4822 310 10671.
  - Wristband tester 4822 344 13999.
- Together with the deflection unit and any multipole unit, the used flat square picture tubes form an integrated unit. The deflection and the multipole units are set optimally at the factory. Adjustment of this unit during repair is therefore not recommended.
- Be careful during measurements in the high-voltage section and on the picture tube.
- Never replace modules or other components while the unit is switched ON.
- When making settings, use plastic rather than metal tools. This will prevent any short circuits and the danger of a circuit becoming unstable.

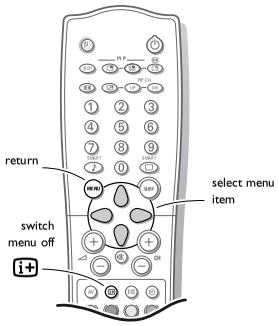
2.4 Notes

- The direct voltages and oscillograms should be measured with regard to the tuner earth (⏚), or hot earth (⏚) as this is called.
- The direct voltages and oscillograms shown in the diagrams are indicative and should be measured in the Service Default Mode (see chapter 5) with a colour bar signal and stereo sound (L: 3 kHz, R: 1 kHz unless stated otherwise) and picture carrier at 475.25 MHz.
- Where necessary, the oscillograms and direct voltages are measured with (⊓) and without (⊼) aerial signal. Voltages in the power supply section are measured both for normal operation (⏻) and in Standby (⏻). These values are indicated by means of the appropriate symbols.
- The picture tube PWB has printed spark gaps. Each spark gap is connected between an electrode of the picture tube and the Aquadag coating.
- The semiconductors indicated in the circuit diagram and in the parts lists are completely interchangeable per position with the semiconductors in the unit, irrespective of the type indication on these semiconductors.
- DOLBY, the double D symbol and PRO LOGIC are trademarks of Dolby Laboratories Licensing Corporation. Manufactured under license from Dolby Laboratories Licensing Corporation.

DOLBY SURROUND
PRO • LOGIC

3. Directions for use

Installation



To use the menus

1. Press the **MENU** key to display/cancel the main menu.
2. Use the cursor in the up/down directions to select a menu item.
   Note: Sometimes not all the menu items are visible on the screen; press the cursor down until all the items are displayed.
3. Use the cursor in the left/right directions to access the sub-menu and to adjust the settings.
4. Press the menu key to return.
5. Press the i+ key to switch the menu off.

```
PICTURE
SOUND
FEATURES
INSTALL
```

Note: If no action is executed, the menu automatically disappears after about 12 seconds.

Store TV channels

Select the menu language

```
PICTURE
SOUND
FEATURES
INSTALL
```

First, select your language.

1. Press the **MENU** key.
2. Select **INSTALL** with the cursor down.
3. Press the cursor right to select **LANGUAGE**.
4. Press the cursor right again.
5. Select your language with the cursor up/down.
6. Press the **MENU** key to return to the main menu.

```
INSTALL
    LANGUAGE
    AUTO STORE
    MANUAL STORE
    SORT
    CHANNEL EDIT
    NAME
```

From now onwards, all on-screen displays will appear in the language that you have chosen.

You can now search for and store the TV channels in two different ways: using Auto store or Manual store (tuning in channel by channel).

Automatic tuning of channels

```
INSTALL
    LANGUAGE
    AUTO STORE
    MANUAL STORE
    SORT
    CHANNEL EDIT
    NAME
```

1. Select **AUTO STORE** in the **INSTALL** menu.
2. Press the cursor right to start the searching.
   All TV channels are searched for and stored automatically.
3. When the tuning is completed, press the **MENU** key to return to the **INSTALL** menu or press the i+ key to switch the menu off.

Note: Channel numbers will always be written in Latin characters, even when a language has been selected which uses other characters.

Preparation

Your remote control

Sleep
Allows you to select a time period after which the set will switch to standby mode automatically.

Standby
- Switch set off temporarily to standby mode. (The red light indicator lights up when set is on standby mode).
- To switch on set from standby mode, press button again.

(Alternate Channel) A/CH
Allows you to alternate between the last viewed channel and the present channel.

PIP (Picture in Picture)**/Dual Window On/Off**
PIP CH UP/DOWN
(if provided) See p. 12

Freeze
Allows you to freeze the main picture.

Screen format
Press this key repeatedly to select another screen format: Auto, 4:3, Expand 4:3 and Compress 16:9. See also p. 11.

Digit (0-9)
Allows you to select a channel.
Note: For a 2-digit number, the second digit must be entered before the "-" sign disappears.

Smart Sound
Allows you to select your desired sound setting from 4 types of sound settings. Press the key repeatedly to select the different settings.

Smart Picture
Allows you to select 5 types of picture settings. Press the key repeatedly to select the different settings.

MENU Displays main menu.
Also exits the menu from the screen or returns to a higher menu level.

SURF
Allows you to select up to a maximum of 10 favourite channels or sources and view quickly the selected channels or sources.

To add a new channel or source:
- Select the channel number or source you want to add to the surf list.
- Press the **SURF** key.
  The request **ADD?** appears next to the selected channel number or source.
- Press the cursor right to add.

To delete a channel or source:
- Select the channel number or source you want to remove from the surf list.
- Press the **SURF** key.
  The request **DELETE?** appears next to the selected channel number or source.
- Press the cursor right to delete.

Press the **SURF** key repeatedly to scroll through the selected channels or sources.

Cursor
Up/Down: allows you to select the next or previous item on the menu and to select another picture format
Left/Right: allows you to access the sub-menus and adjust the settings.

Volume +/-
Increases or decreases volume.

Mute
Mutes the sound. To restore the sound, press the button again.

CH +/- Selects channels in ascending or descending order.

AV Allows you to select the AV channels.

On Screen Display
- Displays the channel number, sound transmission mode, the clock and the status of the sleeptimer.
- Also allows you to exit menu from screen.

I-II
Allows you to switch from **Stereo** to **Mono** sound during stereo transmission or to choose between **Language** I or **Language** II during dual sound transmission.

Timer
Allows you to set the clock to switch to another channel at a specified time while you are watching another channel or when the set is on standby mode.

Colour keys **Teletext**
(if provided) See p. 13
Allows you to access teletext information.

for future use

DOLBY V

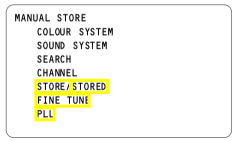
Dolby Virtual *(with Dolby Surround signals)*
Dolby Virtual (Virtual Dolby Surround) enables you to experience the effect of Dolby Pro Logic Surround, reproducing a rear sound effect.

Incredible Surround
In **Stereo** sound mode, when **Incredible Surround** is selected, it seems as though the loudspeakers are spread further apart from one another.

In **Mono** sound mode, this feature, when switched on, enables you to hear a spatial effect of sound.

Active Control On/Off
Measures and corrects all incoming signals in order to provide the best picture quality settings. Press to select the Active Control values On or Off.
ON: Sharpness and Noise Reduction are controlled automatically. The Picture settings are being adapted continuously and automatically. The menu items cannot be selected.

PROGRAM LIST
Allows you to navigate through a list of installed programmes for a quick overview of the channels and activate the channel you have selected.

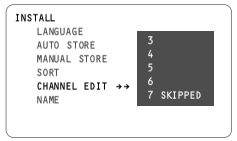


Manual tuning of channels

Manual tuning allows you to store channel by channel.
You must go through every step of the manual store menu.

1. Select **MANUAL STORE** in the **INSTALL** menu.
2. Press the cursor right to enter the menu.
3. Select **COLOUR SYSTEM** and press the cursor right.
   If **AUTO** is selected, the respective colour system will be automatically selected according to the transmission system.
   If the reception is poor, select another colour system with the cursor up/down.
4. Press the **MENU** key or the cursor left.
5. Select **SOUND SYSTEM** and press the cursor right.
   If **AUTO** is selected, the respective sound system will be automatically selected according to the transmission system.
   Note: If the reception is poor, select another sound system with the cursor up/down.
6. Press the **MENU** key or the cursor left.
7. Select **SEARCH** and press the cursor left or right to start the searching.
   Searching stops once a transmitting channel is found.
   Note: If the reception is poor, select another colour and/or sound system.
8. Select **CHANNEL**.
9. Key in the desired channel number with the digit keys or with the cursor left/right.
10. Press the cursor down.

    In case of poor reception, you can improve the reception by adjusting the frequency.
11. Select **FINE TUNE** and press the cursor left/right to adjust.
12. In rare cases certain TV channels may reproduce distorted or unstable pictures.
    Select **PLL** (Phase Locked Loop) to switch to the setting 2 with the cursor left/right to restore the picture for the respective transmission.
13. Press the cursor down to select **STORE**.
14. Press the cursor right.
    The message **STORED** appears and the search menu item is highlighted again.
15. Now repeat steps 7 to 14 to continue searching for another transmitting channel.
16. Press the **MENU** key to return to the **INSTALL** menu or press the i+ key to switch menu off.



Sorting of channels

According to your preference you **can** change the order of the stored TV channels.

1. Select **SORT** in the **INSTALL** menu.
2. Press the cursor right to enter the menu.
3. Key in the channel number in the **FROM** column you want to swap from. Use the digit keys or the cursor left/right.
4. Press the cursor down and select **TO**.
5. Key in the channel number in the **TO** column you want to swap to.
6. Press the cursor down and select **EXCHANGE**.
7. Press the cursor right.
   The message **EXCHANGED** appears and the selected channels are exchanged.
8. Repeat steps 3 to 7 until all TV channel are allocated as you like.
9. Press the **MENU** key to return to the **INSTALL** menu or press the i+ key to switch menu off.

Editing of channels

This feature allows you to edit or skip channels from the channel list which have bad or weak signals or channels which you do not watch often.
*Note: Once a channel is skipped, you cannot select it with the **CH -** or **+** key.*
You can only access the channel with the digit keys.

1. Select **CHANNEL EDIT** in the **INSTALL** menu.
2. Press the cursor right to enter the channel list.
3. Select the channel you want to skip with the cursor up/down.
4. Press the cursor right to skip the selected channel.
   The message **SKIPPED** is displayed.
5. Press the cursor up/down to select another channel and repeat step 4.
6. Press the cursor left or the **MENU** key to return to the install menu or the i+ key to switch menu off.
   Note: to add back channels to the list, repeat steps 1 to 4 and press the i+ key to switch menu off.

Naming of channels

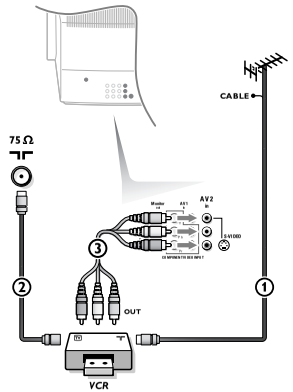
It is possible to assign a name to a TV channel.This feature allows you to enter a new name or modify an existing name of a channel, including peripherals.
Note: Even when you have selected another language in the language menu, only the English language character set is offered to enter names to the TV channels stored.

1. Select a TV channel or peripheral you want to assign a name or modify the existing name.
2. Select **NAME** in the **INSTALL** menu.
3. Press the cursor right to enter the menu.
4. Key in the selected character with the cursor up/down.
5. Move to the next character with the cursor right and key in the next character.You can key up to a maximum of 5 characters.
6. Press the **MENU** key to store the named channel.

Connect Peripheral Equipment

There is a wide range of audio and video equipment that can be connected to your TV. The following connection diagrams show you how to connect them.

Video recorder



1. Connect the RF cable ① to the RF socket ⊓ of your video recorder.
2. Connect another RF cable ② from the output TV of your video recorder to the input ⊓ of your TV.
   Better playback quality can be obtained if you also connect the Video, Audio Left and Right (only for stereo equipment) cables ③ to the **VIDEO**, **AUDIO L/Mono** and **R** input **AV2 IN**.

Note: in case of mono equipment, only the left loudspeaker reproduces sound. Use a mono to stereo adaptor (not supplied) for sound reproduction via all internal loudspeakers.

The **MONITOR OUT** connectors can be used for daisy chaining or to record programmes from your TV. See Record with your video recorder, p. 18.

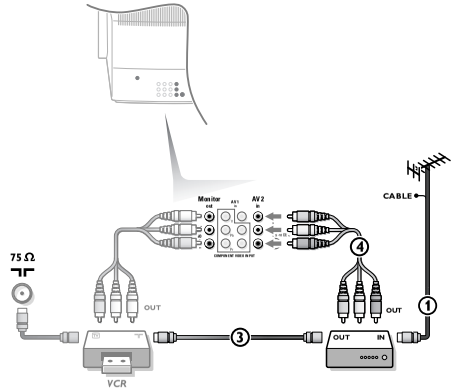
S-VHS-Video quality with a S-VHS video recorder is obtained by connecting the S-VHS-Video cable with the **S-VIDEO** input instead of connecting the video recorder to the **VIDEO** input. (See the instructions of your video recorder.)

If the cables ③ are not used the following steps are required:

Search for and store the test signal of the video recorder

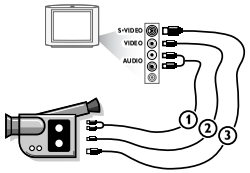
1. Unplug the RF cable ① from the RF socket ⊓ of your video recorder.
2. Switch on your TV and put the video recorder on the test signal or play a prerecorded tape (See the handbook for your video recorder.).
3. Search for the test signal of your video recorder in the same way as you searched for and stored the TV signals. See Installation, Store TV Channels, Manual Tuning, p. 5.
4. Store the test signal under programme number 0 or between 90 and 99.
5. Replace the RF cable in the RF socket ⊓ of your video recorder after you have stored the test signal.

Video recorder and other A/V peripherals



1. Interconnect your video recorder with extra RF cables ③.
2. To obtain better picture quality, also connect the Video, Audio left and Audio right (only for stereo equipment) cables to the **VIDEO**, **AUDIO L/Mono** and **AUDIO R** input of **AV2 IN** sockets ④.

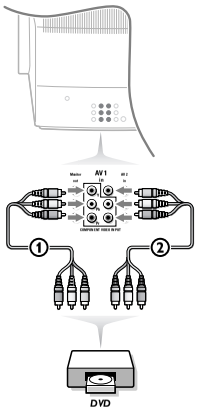
Note: in case of mono equipment, only the left loudspeaker reproduces sound. Use a mono to stereo adaptor (not supplied) for sound reproduction via all internal loudspeakers.
When a video recorder is not connected to MONITOR OUT you can only record a programme from the aerial or from the cable system.
Only when a video recorder is connected to MONITOR OUT it is possible to record a programme from other equipment connected to the TV. See Record with your video recorder, p. 18.



Camera & camcorder

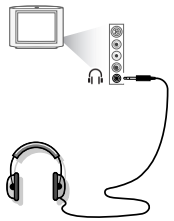
1. Connect your camera or camcorder to sockets at the right side of your TV.
2. Connect the equipment to **VIDEO** (2) and **AUDIO L** (1) for mono equipment.
3. For stereo equipment also connect **AUDIO R** (1).

S-VHS quality with an S-VHS camcorder is obtained by connecting the S-VHS cables with the **S-VIDEO** input (3) (instead of **VIDEO** (2)) and **AUDIO** inputs (1).



DVD-player

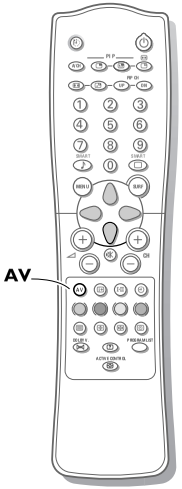
1. Connect the cables of your **Y-Pb-Pr** DVD player (1) to the **Y-Pb-Pr** input **AV1** in sockets on the TV.
   For correct picture reproduction also connect to **VIDEO**.
   (See the handbook of your DVD player.)
2. Connect the Audio left and right (only for stereo equipment) cables to the **AUDIO L/Mono** and **R** input.



Headphone

1. Insert the plug into the headphone socket at the right side of the TV.
2. Press on the remote control to switch off the internal loudspeakers of the TV.
   The headphone impedance must be between 8 and 4000 Ohm.
   The headphone socket has a 3.5 mm jack.

In the **SOUND** menu select **Headphone** to adjust the headphone volume and balance.



To select connected equipment

Equipment connected with an aerial cable only :
Select the channel number under which you have stored the test signal with the digit keys.

Equipment connected to the back or to the right side of the TV
Press the **AV** key repeatedly to select **AV1**, **CVI**, **AV2** or **FRONT**, according to where you connected your equipment at the back or the right side of your TV.
Select **CVI** to view the playback of DVD discs if you used the Component Video Input sockets (**Y-Pb-Pr** and **AUDIO L**, **Mono** and **R** inputs).

If you want to change to TV channels?
Enter the channel number of the TV channel which you want to watch with the digit keys.

Record with your video recorder

To record S-VHS quality, connect an S-VHS peripheral directly to the video recorder.

Record a TV programme

1. Select the channel number on your video recorder.
2. Set your video recorder to record.
   See the handbook for your video recorder.

Switching channel numbers on your TV does not disturb recording !

Record a programme on your video recorder connected to MONITOR OUT from Audio/Video equipment connected to AV1, AV2 or to sockets on the right side of the TV

1. Switch on the equipment.
2. Select the correct external on your TV and on your video recorder.
3. Set your video recorder to record.
   You record what you are watching on the screen.

Do not switch channel numbers or do not switch off your TV when you are recording !

Before Calling Service

Please make these simple checks before calling service. These tips may save you time and money since charges for television installation and adjustments of customer controls are not covered under your warranty.

Symptoms	Items to Check and Actions to follow
"Ghost" or double images	• This may be caused by obstruction to the antenna due to high rise buildings or hills. Using a highly directional antenna may improve the picture.
No power	• Check that the television's AC power cord is plugged into the mains socket. • Unplug the television, wait for 60 seconds. Then re-insert the plug into the mains socket and turn on the television again.
No picture	• Check the antenna connection at the rear of the television to see if it is properly connected to the television input terminal. • Possible broadcast station trouble. Try another channel. • Adjust the contrast and brightness settings or select another picture setting with the smart picture key.
Good picture but no sound	• Increase the VOLUME. • Check that the television is not muted, press the 🔇 button on the remote control. • When no signal is detected, the television automatically switches off the sound. This is proper operation and does not indicate a malfunction. • Check the transmission system's sound settings of this set.
Good sound but poor colour or no picture	• Adjust the contrast and brightness setting or select another picture setting with the smart picture key. • Check the transmission system's colour settings of this set.
Poor picture	• Sometimes, poor picture quality occurs when having activated an S-VHS camera or camcorder connected to the right side of of your TV and another peripheral is connected to AV1 or AV2 at the same time. In this case, switch off one of the other peripherals.
Snowish picture and noise	• Check the antenna connection.
Horizontal dotted line	• This may be caused by electrical interference (e.g. hairdryer, nearby neon lights, etc.) • Turn off the equipment.
One white line across the screen	• Turn off the television immediately and consult a qualified service personnel.
Television not responding to remote control	• Check whether the batteries are working. Replace if necessary. • Clean the remote control sensor lens on the television. • Operating range between television and the remote control should not be more than 6 meters. • You can still use the keys at the top of your TV.
NICAM sound distortion (crackling noise)	• This could be due to antenna siting or reflected signal. • Switch over to "MONO" mode by pressing the I-II key.
Wrong menu	• Press the i+ key again to exit from the menu.

If your problem is not solved

Turn your TV off and then on again once.

Never attempt to repair a defective TV yourself.

Check with your dealer or call a TV technician.

Personal notes:

4. Mechanical instructions

4.1 Removing the Rear Cover

1. Remove all the fixation screws of the rear cover.
2. Now the rear cover can be removed by pulling it backward.

4.2 Service positions

4.2.1 Service position LSP

Position 1: For better accessibility of the LSP, do the following:

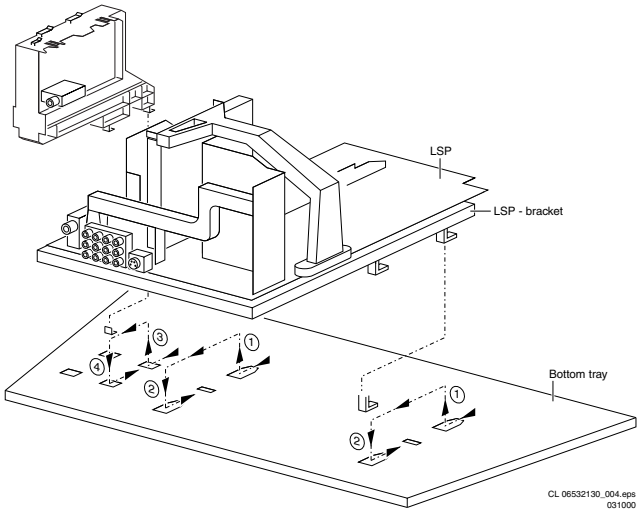


Figure 4-1

1. Remove the LSP-module from the bottom tray by pulling the complete module back- and then upward.
2. Hook the bracket in the first row of fixation holes of the cabinet bottom. In other words reposition the bracket from [1] to [2].
3. The same can be done with the DW-module (position [3] to [4]).

Position 2: This service position is comparable to that of the A10A. To get access to the bottom side (solder side) of the LSP, do the following:

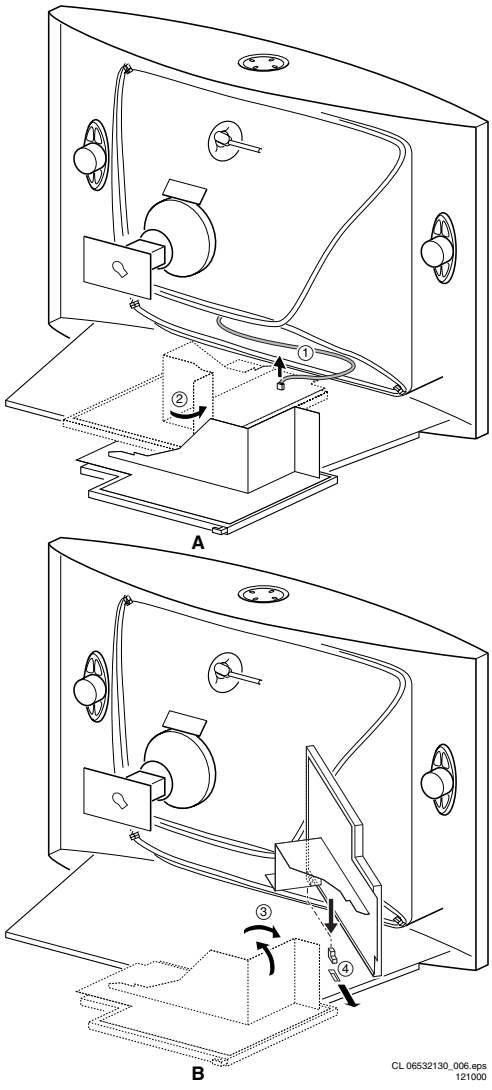


Figure 4-2

1. Disconnect the CRT/SCAVEM panel from the CRT-socket.
2. Release LSP and DW-module, and pull backward.
3. Remove Mains switch module from bottomplate (see description below).
4. Free the necessary wiring from their fixation clamps, for the ease of handling.
5. Sometimes a cable must be disconnected for the ease of handling, like the degaussing coil (0020) and loudspeaker (1735, 1736 & 1737) cables.
6. Now reposition following modules, in order to cope with the LSP service position:
   – DAF-module from the LSP-bracket by pressing lever while pushing the module forward in the direction of the CRT (see also description below).
   – Mains Harmonic module from the LSP-bracket by removing 1 screw and then slide the module backward, away from the CRT (see also description below).
7. Turn the chassis tray 90 degrees counter clockwise (see figure 4.2 - [2]).
8. Flip the chassis tray with the rear I/O panel towards the CRT [3].
9. Place the hook of the tray in the fixation hole at the right side of the cabinet bottom and pull the chassis tray backward [4].

10. Reconnect cables (except degaussing cable 0020), panels and modules.

Alternative position 2: A somewhat easier way to access the bottom side (solder side) of the LSP is the following (only possible when the high tension cable is long enough):

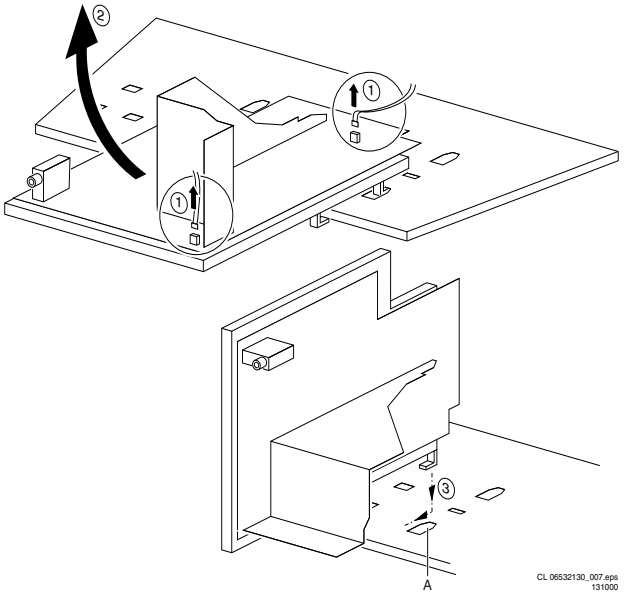


Figure 4-3

1. Disconnect the CRT/SCAVEM panel from the CRT-socket.
2. Release LSP and DW-module, and pull backward.
3. Remove Mains switch module from bottomplate (see description below).
4. Free the necessary wiring from their fixation clamps, for the ease of handling.
5. Sometimes a cable must be disconnected for the ease of handling, like the degaussing coil (0020), loudspeaker (1735, 1736 & 1737) cables and 0325 (frame deflection).
6. Now reposition following modules, in order to cope with the LSP service position:
   – DAF-module from the LSP-bracket by pressing lever while pushing the module forward in the direction of the CRT (see also description below).
   – Mains Harmonic module from the LSP-bracket by removing 1 screw and then slide the module backward, away from the CRT (see also description below).
7. Flip the chassis tray 90 degrees clockwise [2].
8. Place the hook of the tray in fixation hole [A] of the cabinet bottom and pull the chassis tray backward [3].
9. Reconnect the cables (except degaussing cable 0020), panels and modules.

4.2.2 Service position SSB

All relevant test points can be accessed with the SSB in original position, but for ease of use a 'SSB extension board' is available under number 9965 000 05769.
Before usage of this board, the 'LSP top-bracket' has to be taken out. This can be done by:

1. Remove the DAF panel (see 4.2.5).
2. Remove the 2 screws which hold the bracket at the right side.
3. Lift the bracket at the same side. It hinges at the cooling plate.

Note: For some type numbers, the LSP has to be moved slightly to the right side in order to create enough space for the SSB extension board.

To get access to the test points of the SSB, the shielding has to be removed:

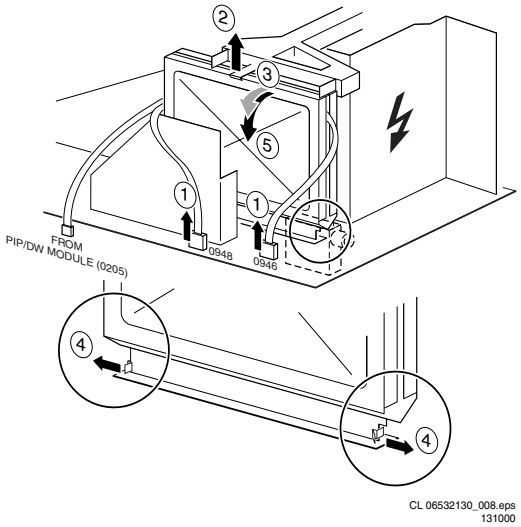


Figure 4-4

1. Put the LSP in service position 1 (as described above).
2. If a PIP/DW module is present, then disconnect the IF-cable from connector 1946, flatcable from connector 1948 and flatfoil on DW-module connector 0205 [1].
3. Release the 'top fixation clamp' which holds the SSB [2] and pull the SSB slightly towards the Tuner [3]. At the same time, the 2 metal clamps at both sides of the SIMM-connector must be released [4] . The complete SSB can be taken out now by pulling the topside of the SSB towards the Tuner [5]. It 'hinges' in the SIM-connector.

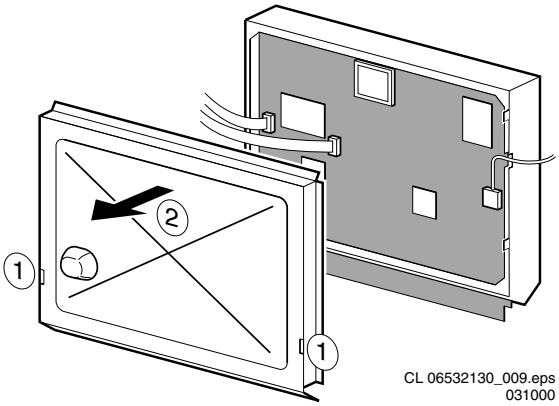


Figure 4-5

1. Once the SSB has been taken out of the connector, the shielding can be removed.
2. After removal of the shielding, the panel can be replaced in its connector in reverse order. Don't forget to reconnect the cables.
3. If necessary for the measurement, the LSP can be put in 'service position 2' (as described above).

4.2.3 Accessing the Double Window (DW) panel

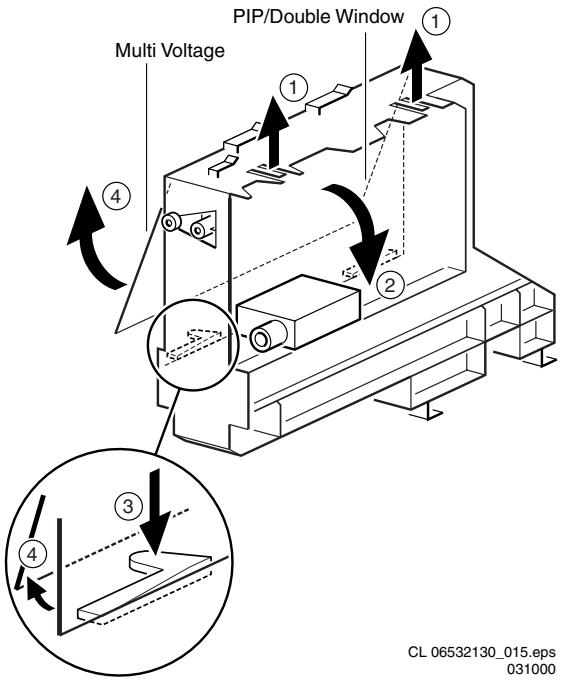


Figure 4-6

1. Remove the DW bracket from the bottom tray by pulling it backward (after pressing the fixation clamp).
2. The board can easily be lifted out of the bracket [2] after releasing the 2 fixation clamps [1].

4.2.4 Accessing the Multi Voltage panel (if present)

1. Remove the DW bracket from the bottom tray by pulling it backward.
2. Press the 2 fixation clamps downward [3] (see figure 4-7).
3. The board can easily be lifted out of the bracket after releasing the 2 fixation clamps [4].

4.2.5 Accessing the Double Astigmatic Focus (DAF) panel

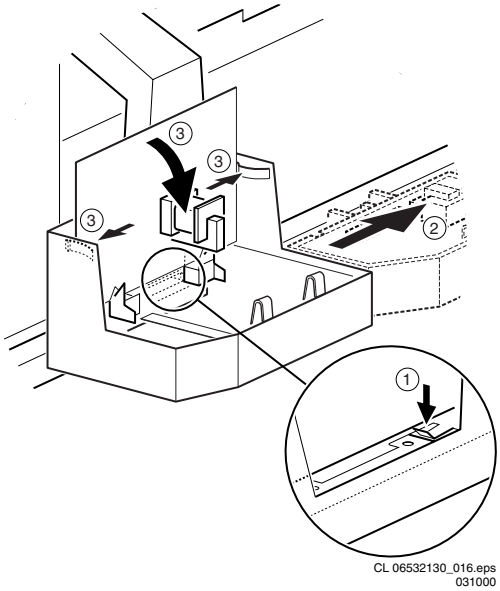


Figure 4-7

1. The complete module can be removed from the LSP-bracket by pressing its fixation clamp [1] (located behind the PWB), while sliding the module in the direction of the CRT [2].
2. The board can easily be lifted from its bracket after releasing the 2 fixation clamps [3].

4.2.6 Accessing the Mains Harmonic panel

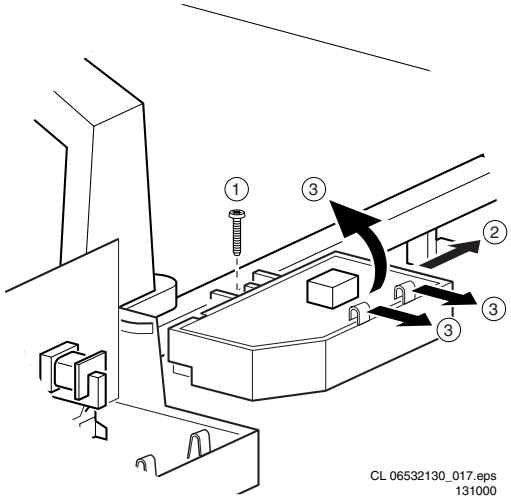


Figure 4-8

1. The complete module can be removed from the LSP-bracket (**after removal of the DAF-panel**) by removing screw [1] and then slide the module in the opposite direction of the CRT [2].
2. The board can easily be lifted from its bracket after releasing the 2 fixation clamps [3].

4.2.7 Accessing the Top Control panel

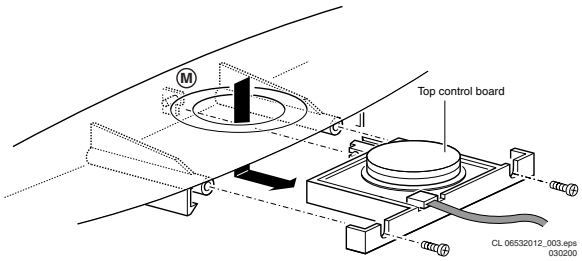


Figure 4-9

1. Remove the two fixation screws, which hold the panel.
2. Pull the board backward (w.o.w. release it from its front hinge [M]).
3. The board can easily be lifted from its bracket after releasing the 2 fixation clamps at the connector side.

4.2.8 Accessing the Side I/O panel

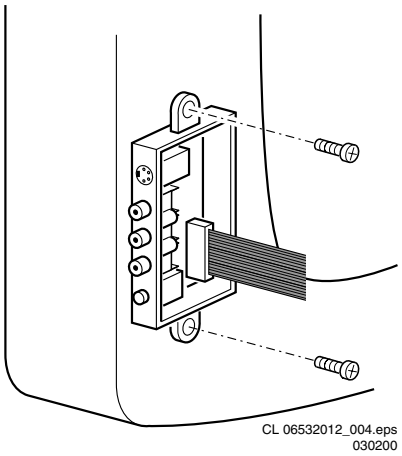


Figure 4-10

4.2.9 Accessing the Mains Switch panel

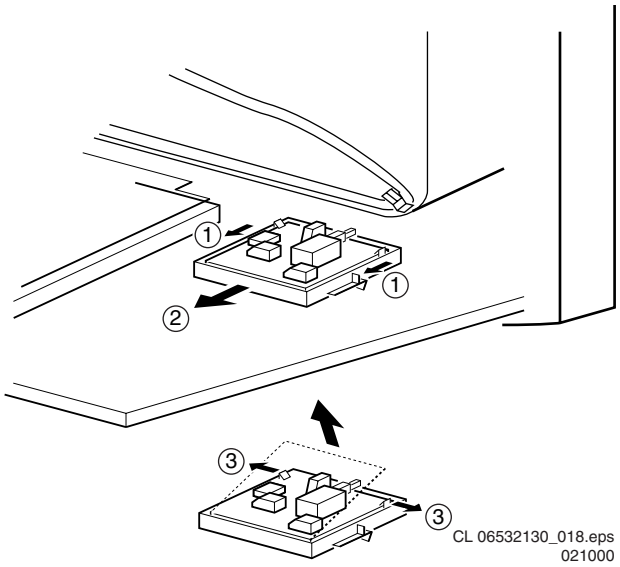


Figure 4-11

The easiest way to access this module is with the LSP in service position 2.

1. Release the two fixation clamps by pulling them backward [1].
2. At the same time, the complete assy must be pulled backward [2].
3. If the board has to be removed, release the 2 clamps at the bracket sides and lift panel up [3].
1. The complete Side I/O-assembly can easily be removed by unscrewing the 2 fixation screws.
2. The board can easily be lifted out of the bracket after releasing the 2 fixation clamps.

4.3 Mounting the Rear Cover

Before mounting the Rear Cover, some checks has to be performed:

- Check whether the Mains Cord is mounted correctly in the guiding brackets.
- Check whether all cables are replaced in their original position. This is very important due to the large 'hot' area of the set.

5. Fault finding and repair tips

In this chapter the following paragraphs are included:
1. Test points.
2. Service Modes.
3. Problems and solving tips (related to CSM).
4. ComPair.
5. Error codes.
6. The 'blinking LED' procedure.
7. Protections.
8. Repair tips.

5.1 Test points

The EM1A chassis is equipped with test points in the service printing. These test points are referring to the functional blocks:
- A1-A2-A3, etc.: Test points for the audio processing circuitry [A5, A6, and B6].
- C1-C2-C3, etc.: Test points for the control circuitry [B7].
- F1-F2-F3, etc.: Test points for the frame drive and frame output circuitry [A4, B4] and Double Window [C].
- F1F-F2F, etc.: Test points for the RGB-signals on the CRT panel [F].
- I1-I2-I3, etc.: Test points for the intermediate frequency circuitry [A7, B2].
- L1-L2-L3, etc.: Test points for the line drive and line output circuitry [A3, B4].
- P1-P2-P3, etc.: Test points for the power supply [A1, A2].
- SC1-SC2, etc.: Test points for the synchronisation circuitry on the CRT panel [F].
- V1-V2-V3, etc.: Test points for the video processing circuitry [B].

The numbering is done, in a for diagnostics logical sequence; always start diagnosing within a functional block in the sequence of the relevant test points for that functional block.

Measurements are performed under the following conditions:
- Service mode: SDM.
- Video: colour bar signal.
- Audio: 3 kHz left, 1 kHz right.

5.2 Service modes

5.2.1 Service Default Mode (SDM)

Purpose
- To provide a situation with predefined settings to get the same measurement results as given in this manual.
- Start the 'Blinking LED' procedure.
- Have the possibility to override the 5V-protection.

Specification
- Tuning frequency 475.25 MHz for PAL/SECAM sets and at channel 3 (61.25 MHz) for NTSC-sets.
- All picture settings at 50 % (brightness, colour, contrast, hue).
- All sound settings at 50 % except volume at 25 % (so bass, treble, balance at 50 %, volume at 25 %).
- All service-unfriendly modes are disabled, like timer, sleep timer, parental lock, blue mute, hospitality mode and no-ident timer (normally the set is automatically switched off when no video signal - IDENT - was received for 15 minutes).

Entering
- Via a standard RC-handset by entering the code '062596' followed by the 'MENU' button.
- Via ComPair.
- Via grounding the 'Front Detect'-line on the Side I/O panel **during switch ON** (pins 1 and 7 of connector 0936).
- By the 'DEFAULT' button on the DST while the set is in the normal operation mode.

CAUTION: Entering SDM by grounding the 'Front Detect'-line will override the 5V-protection. **This should only be done for a short period of time.** In case of SW-protections (errors 1 - 4), the set will shutdown in 15 s.
When doing this, the service-engineer must know what he is doing as it could lead to damaging the set.

After entering SDM, the following screen will be shown with 'SDM' at the upper right side for recognition.

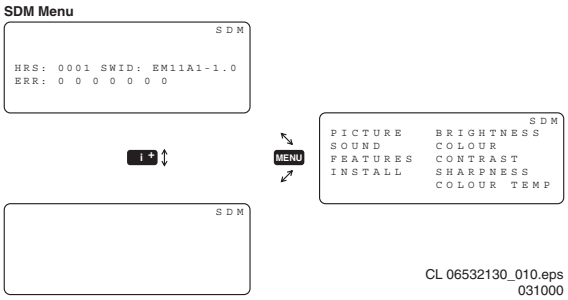


Figure 5-1

Explanation

Access to normal user menu
Pressing the 'MENU' button on the remote control, switches between the SDM and the normal user menus (with the SDM mode still active in the background).

Error buffer
Pressing the 'OSD' button [i+] of the remote control, shows / hides the error buffer. OSD can be hidden to prevent interference with oscillogram measurements.

Access to SAM
By pressing the 'VOLUME +' and 'VOLUME -' buttons on the local keyboard **simultaneously for a few seconds**, the set toggles from SDM to SAM.

Exiting
There are 2 ways to exit this mode:
- Switch the set to 'STANDBY', the error buffer will also be cleared (by switching the set OFF-ON with the mains switch, the set will come up again in the SDM).
- By pressing the 'EXIT' button on the DST.

5.2.2 Service Alignment Mode (SAM)

Purpose
- To perform alignments.
- To change option settings.
- To display / clear the error code buffer.

Specification
- Software alignments (see chapter 8).
- Option settings (see chapter 8).
- Error buffer reading and erasing. The most recent error code is displayed on the left side.
- Operation counter.
- Software version.

Entering

- Via a standard RC-handset by entering the code '062596' followed by the 'OSD' button [i+].
- Via ComPair.
- By the 'ALIGN' button on the DST while the set is in the normal operation mode.

The following screen will be shown, with 'SAM' at the upper right side for recognition.

SAM Menu

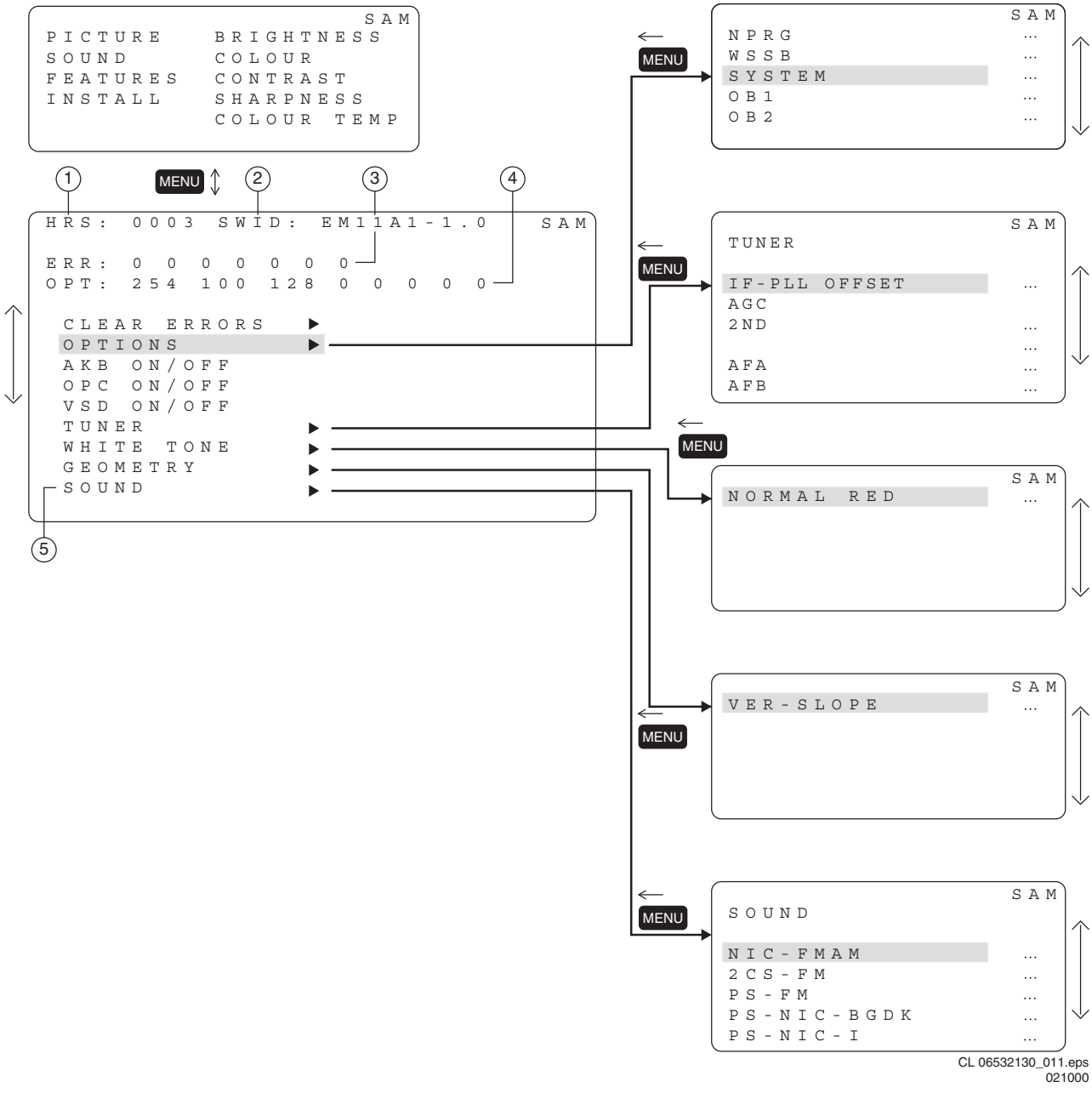


Figure 5-2

Explanation

The Service Alignment Mode menu will now appear on the screen. The following information is displayed:

1. Operation hours timer (hexadecimal).
2. Software identification of the main micro controller (AAABBB-X.Y).
   - AAA is the chassis name (EM1= Painter processor, EM2= OTC processor).
   - B = Software code belonging to a certain stroke number (see table below).
   - X = (main version number).
   - Y = (subversion number).
3. Error buffer (7 errors possible).
4. Option bytes (8 codes possible), summary of options are explained below.
5. Sub menus are listed in a scroll-menu.

Country	Strokenumber	Software
Singapore	/69	2A1
Thailand		
Malaysia		
Indonesia		
Middle East	/56	2A2
China	/93	1A1
Hong Kong	/57	2A1
Australia	/79	
New Zealand		

Menu control
Menu items can be selected with the 'CURSOR UP/DOWN' key. The selected item will be highlighted. When not all menu items fit on the screen, moving the 'CURSOR UP/DOWN' will display the next/previous menu items.
With the 'CURSOR LEFT/RIGHT' keys, it is possible to:
- (De)activate the selected menu item (e.g. GEOMETRY).
- Change the value of the selected menu item (e.g. VER-SLOPE).
- Activate the selected submenu (e.g. SERV-BLK).

Access to normal user menu
Pressing the 'MENU' button on the remote control switches between the SDM and the normal user menus (with the SAM mode still active in the background). Pressing the 'MENU' key in a submenu will go to the previous menu.

The menus and submenus
- CLEAR ERRORS. Erasing the contents of the error buffer. Select the CLEAR ERRORS menu item and press the 'CURSOR RIGHT' key. The content of the error buffer is cleared.
- The functionality of the OPTIONS and ALIGNMENTS (TUNER, WHITE TONE, SOUND, GEOMETRY and SMART SETTING) sub menus is described in chapter 8.

Exiting
There are 2 ways to exit this mode:
- Switch the set to 'STANDBY', the error buffer will also be cleared (by switching the set OFF-ON with the mains switch, the set will come up again in the SAM).
- By pressing the 'EXIT' button on the DST.

5.2.3 Customer Service Mode (CSM)

Purpose
The 'Customer Service Mode' is a special service mode, which can be activated and deactivated by the customer upon request of the service technician/dealer during a telephone conversation, in order to identify the status of the set. This CSM is a 'read only' mode, therefore modifications in this mode are not possible.

Entering
The Customer Service Mode will switch ON after pressing the 'MUTE' key on the remote control handset and any of the top control buttons on the TV for at least 4 seconds simultaneously. This activation only works if there is no menu on the screen.

Explanation
After switching on the Customer Service Menu the following screen will appear:

CSM Menu

```
                                                    CSM
1   HRS: 0005 SWID: EM11A1-1.0
2   CODES: 0 0 0 0 0 0 0
3   OPT: 254 100 128 0 0 0 0 0
4   SYSTEM: AUTO          11 SOUND: MONO
5   NO SIGNAL             12 VOLUME:          ...
6   TIMER ON              13 BALANCE: +/-     ...
7   CHANNEL BLOCKED       14 HUE:     +/-     ...
8   NOT PREFERRED         15 COLOUR:          ...
9   HOTELMODE ON          16 BRIGHTNESS:      ...
10  SOURCE: 1             17 CONTRAST:        ...
```

CL 06532130_012.eps
131000

Figure 5-3

Line 1:
HRS: *Hexadecimal* counter of operating hours (example: 1B (hex) = 0001 1011 (bin) = 27 (dec)). Standby hours are not counted as operating hours.
SWID: Software identification of the main micro controller (see paragraph 5.2.2). Details on available software versions can be found in the chapter 'Software Survey' of the publication 'Product Survey - Colour Television'.

Line 2:
Error code buffer (for more details see paragraph 5.3). Displays the last 7 errors of the error code buffer.

Line 3:
Software and hardware functionality of the EM1A is controlled by option bits. An option byte or option number represents 8 of those bits. Each option number is displayed as a decimal number between 0 and 255. The set may not work correctly when an incorrect option code is set. See chapter 8 for more information on correct option settings

Line 4:
Indicates which colour and sound system is installed for the selected pre-set:
Line 5:
Indicates that the set is not receiving an 'ident' signal on the selected source.
Note: On some models, BLUE MUTE is displayed (if the BM option is ON) when no signal is received.

Line 6:
Indicates whether the SLEEPTIMER function is ON/OFF.

Line 7:
Indicates whether the CHILD LOCK function is ON/OFF.

Line 8:
Indicates whether the current pre-set is defined as SKIPPED or NON-PREFERRED.

Line 9:
Indicates whether the HOTEL MODE is activated.

Line 10:
Indicates which SOURCE is installed for this pre-set: EXT1, SVHS2, EXT2, and Tuner.

Line 11:
Indicates which sound mode is installed for this pre-set: Mono, NICAM, Stereo, L1, L2, SAP or Virtual

Line 12 to 17:
Value indicates parameter levels at CSM entry.

Exiting
The Customer Service Mode will switch OFF after pressing any key of the remote control handset (with exception of the 'P+' and 'P-' keys) and switching OFF the TV set with the mains switch.

5.3 Problems and solving tips (related to CSM)

5.3.1 Picture problems

No colours / noise in picture
Check CSM line 4. Wrong colour system installed. To change the setting:
1. Press the 'MENU' button on the remote control.
2. Select the INSTALL sub menu.
3. Select the MANUAL STORE sub menu.
4. Select and change the COLOUR SYSTEM setting until picture and sound are correct.
5. Select the STORE menu item.

Colours not correct / unstable picture
Check CSM line 4. Wrong colour system installed. To change the setting:
1. Press the 'MENU' button on the remote control.
2. Select the INSTALL sub menu.
3. Select the MANUAL STORE sub menu.
4. Select and change the COLOUR SYSTEM setting until picture and sound are correct.
5. Select the STORE menu item.

TV switches off or changes channel without any user action
The TV-set switches off after 'TV SWITCHING OFF' was displayed.
Auto standby switched the set off because:
- There was no ident signal for more than 15 minutes.
- There was no remote control signal received or local key pressed for > 2 hours.

See chapter 8 for a description on the options to enable/ disable auto standby

Picture too dark or too bright
- Press 'Smart Picture' button on the remote control. In case the picture improves, increase / decrease the brightness value or increase / decrease the contrast value. The new 'Personal Preference' value is automatically stored after 3 minutes.
- After switching on the Customer Service Mode the picture is OK. Increase / decrease the brightness value or increase / decrease the contrast value. The new 'Personal Preference' value is automatically stored after 3 minutes.

White line around picture elements and text
- Press 'Smart Picture' button on the remote control. In case the picture improves, decrease the sharpness value. The new 'Personal Preference' value is automatically stored after 3 minutes.
- After switching on the Customer Service Mode the picture is OK. Decrease the sharpness value. The new 'Personal Preference' value is automatically stored after 3 minutes.

Snowy picture
Check CSM line 5. If this line indicates NO SIGNAL, check following:
- no or bad antenna signal; connect a proper antenna signal
- antenna not connected; connect the antenna
- no channel / pre-set is stored at this program number; go to the INSTALL menu and store a proper channel at this program number
- the tuner is faulty (in this case the CODES line will contain number 13 or 16); check the tuner and replace/ repair if necessary

Snowy picture and/or unstable picture
- A scrambled or decoded signal is received.

Black and white picture
- Press 'Smart Picture' button on the remote control. In case picture improves, increase the COLOUR value. The new 'Personal Preference' value is automatically stored after 3 minutes.
- After switching on the Customer Service Mode the picture is OK. Increase the COLOUR value. The new 'Personal Preference' value is automatically stored after 3 minutes.

Menu text not sharp enough
- Press 'Smart Picture' button on the remote control. In case the picture improves, decrease the CONTRAST value. The new 'Personal Preference' value is automatically stored after 3 minutes.
- After switching on the Customer Service Mode the picture is OK. Decrease the CONTRAST value. The new 'Personal Preference' value is automatically stored after 3 minutes.

5.3.2 Sound problems

No sound or sound too loud (after channel change / switching on)
- After switching on the Customer Service Mode the volume is OK. Increase / decrease the volume level. The new 'Personal Preference' value is automatically stored after 3 minutes.

5.4 ComPair

5.4.1 Introduction

ComPair (Computer Aided Repair) is a service tool for Philips Consumer Electronics products. ComPair is a further development on the DST service remote control allowing faster and more accurate diagnostics. ComPair has three big advantages:
1. ComPair helps you to quickly get an understanding how to repair the EM1A in short time by guiding you step by step through the repair procedures.
2. ComPair allows very detailed diagnostics (on I2C level) and is therefore capable of accurately indicating problem areas. You do not have to know anything about I2C commands yourself; ComPair takes care of this.
3. ComPair speeds up the repair time since it can automatically communicate with the EM1A (when the microprocessor is working) and all repair information is directly available. When ComPair is installed together with the SearchMan EM1A electronic manual, schematics and PWBs are only a mouse-click away.

ComPair consists of a Windows based faultfinding program and an interface box between PC and the (defective) product. The ComPair interface box is connected to the PC via a serial or RS232 cable. In case of the EM1A chassis, the ComPair interface box and the TV communicate via a bi-directional service cable via the service connector at the rear side of the set (located at the left side of the rear cinch connectors, see also figure 1-2).
The ComPair faultfinding program is able to determine the problem of the defective television. ComPair can gather diagnostic information in 2 ways:
1. Communication to the television (automatic)
2. Asking questions to you (manually)

ComPair combines this information with the repair information in its database to find out how to repair the TV-set.

Automatic information gathering
Reading out the error buffer, ComPair can automatically read out the contents of the entire error buffer.
Diagnosis is done on I2C level. ComPair can access the I2C bus of the television. ComPair can send and receive I2C commands to the micro controller of the television. In this way it is possible for ComPair to communicate (read and write) to devices on the I2C busses of the TV-set.

Manual information gathering
Automatic diagnosis is only possible if the micro controller of the television is working correctly and only to a certain extend. When this is not the case, ComPair will guide you through the faultfinding tree by asking you questions and showing you examples. You can answer by clicking on a link (e.g. text or a waveform picture) that will bring you to the next step in the faultfinding process.

A question could be: Does the screen give a picture? (Click on the correct answer)
YES / NO
An example can be: Measure test-point I7 and click on the correct oscillogram you see on the oscilloscope

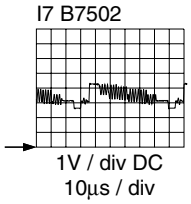


Figure 5-4

By a combination of automatic diagnostics and an interactive question/answer procedure, ComPair will enable you to find most problems in a fast and effective way.

Additional features
Beside fault finding, ComPair provides some additional features like:
- Uploading/downloading of pre-sets.
- Managing of pre-set lists.
- Emulation of the Dealer Service Tool.

5.4.2 SearchMan (Electronic Service Manual)

If both ComPair and SearchMan are installed, all the schematics and the PWBs of the faulty set are available when clicking on the hyper-link of a schematic or a PWB in ComPair. Example: Measure the DC-voltage on capacitor C2568 (Schematic/Panel) at the Monocarrier.
Clicking on the PWB hyper-link automatically shows the PWB with a highlighted capacitor C2568. Clicking on the schematic hyper-link automatically shows the position of a highlighted capacitor at the schematic.

5.4.3 Connecting the ComPair interface

The ComPair Browser software should be installed and set-up before connecting the ComPair interface to the TV-set (see the ComPair Browser Quick Reference Card for installation instructions).
1. Connect the RS232 interface cable to a free serial (COM) port on the PC and the ComPair interface PC connector (connector marked with 'PC').
2. Connect the mains adapter to the connector marked 'POWER 9V DC' on the ComPair interface.
3. Switch the ComPair interface 'OFF'.
4. Switch the television set 'OFF' with the mains switch.
5. Connect the interface cable to the connector on the rear side of the ComPair interface that is marked 'I^2C' (see figure 5-6).
6. Connect the other end of the interface cable to the ComPair connector on the monocarrier (left to the rear cinch connectors).
7. Plug the mains adapter in the mains outlet and switch 'ON' the interface. The green and red LEDs light up together. The red LED extinguishes after approx. 1 second (the green LED remains lit).
8. Start-up ComPair and select 'File' menu, 'Open...:; select 'EM1A Fault finding' and click 'OK'.
9. Click on the icon to switch 'ON' the communication mode (the red LED on the ComPair interface will light up).
10. Switch 'ON' the TV-set with the mains switch.
11. When the set is in standby, click on 'Start-up in ComPair mode from standby' in the ComPair EM1A faultfinding tree, otherwise continue.

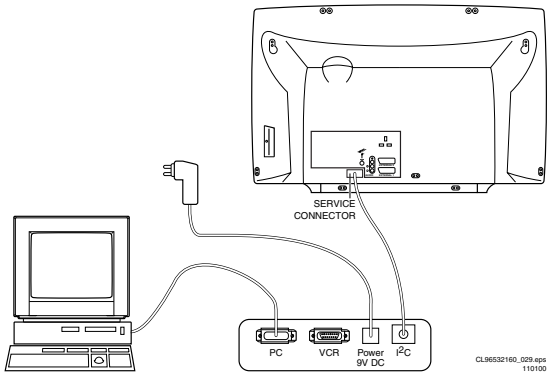


Figure 5-5

The set has now started up in ComPair mode. Follow the instruction in the EM1A faultfinding tree to diagnose the set. Note that the OSD works but that the actual user control is disabled

5.4.4 Pre-set installation

Pre-sets can be installed via the service cable:
- sending TO the television and reading FROM the television
- the rear cover does NOT have to be removed

Click on '**File**', '**Open**' and select '**EM1A fault finding**' to use the cable.
Pre-sets can be installed via menu '**Tools**', '**Installation**' and '**Pre-sets**'.

5.4.5 Ordering ComPair

ComPair order codes:
- Starter kit ComPair + SearchMan software + ComPair interface (excluding transformer): 4822 727 21629
- ComPair interface (excluding transformer): 4822 727 21631
- Starter kit ComPair software: 4822 727 21634
- Starter kit SearchMan software: 4822 727 21635
- Starter kit ComPair + SearchMan software: 4822 727 21636
- ComPair CD (update): 4822 727 21637
- SearchMan CD (update): 4822 727 21638
- ComPair interface cable (for EM1A): 4822 727 21641

5.5 Error codes

5.5.1 Error buffer

The error code buffer contains all errors detected since the last time the buffer was erased. The buffer is written from left to right. When an error occurs that is not yet in the error code buffer, the error is written at the left side and all other errors shift one position to the right.

The error code buffer will be cleared in the following cases:
- By activating 'CLEAR ERRORS' in the SAM menu:
  - Exiting SDM or SAM with the 'Standby' command on the remote control (by leaving SDM or SAM with the mains switch, the error buffer is not reset).
  - Transmitting the commands 'DIAGNOSE 99 OK' with the DST (RC7150) or with ComPair
- Automatically reset if the content of the error buffer has not changed for 50 hours

Examples:
ERROR: 0 0 0 0 0 0 0 : No errors detected
ERROR: 6 0 0 0 0 0 0 : Error code 6 is the last and only detected error

ERROR: 9 6 0 0 0 0 0 : Error code 6 was first detected and error code 9 is the last detected (newest) error

The contents of the error buffer can also be made visible through the 'blinking LED' procedure. This is especially useful when there is no picture. See paragraph 5.6 'The blinking LED procedure '.

5.5.2 Error codes

In case of non-intermittent faults, clear the error buffer before starting the repair. This is to prevent that 'old' error codes are still present.

If possible, check the entire content of the error buffer. In some situations an error code is only the result of another error code (and not the actual cause). E.g. a fault in the protection detection circuitry can also lead to a protection.

Error	Device	Description	Def. item	Diagram
0				
1	FBX 3V3 prot	FBX 3V3 protection	5703	B3
2	No HFB	No Horizontal Flyback	0325	A4
3	X-Ray protection	X-Ray protection		
4	5 V protection	5 V protection	1200/7651	A7/B6
5	No HOP POR	Startup failure		B4
6	General I^2C bus error	General I^2C bus error		
7	Mains Dip error	HW-error		
10	MC24C32	NVM communication error	7012	B7
11	MC24C32	NVM identification error	7012	
12	SAA5667	Main µP, int. RAM test failure	7001	B7
13	TEDE9	Main Tuner	1200	A7
14	MSP3415D	MSP34xx	7651	B6
15	CY7C1019	SRAM test failure	7011	B7
16	TELE9	PIP/DW Tuner	7201	C2
17	SAB9081H	Multi PIP-IC	7801	C1
18	M62320P	PIP/DW IO-expander	7403	C3
23	TDA888xx	PIP/DW BOCMA-IC	7301	C4
27	Virtual Dolby	Virtual Dolby error		
30	TDA9320	HIP I/O-video processing	7323	B2
31	SAA4978	PICNIC	7709	B3
32	TDA9330	HOP video control/geometry	7301	B4

Explanation of error codes:

Error 0
No errors.

Error 1
This protection is activated, when the PICNIC (pos. 7709 on diagram B3) can not communicate via I2C for a certain time. This could mean that stabiliser 7713 is defective. When e.g. 2704 makes a short circuit to ground, 7713 will become very hot. For safety reasons the set will be switched to protection mode.

Error 2
The absence of an HFB-pulse (pin 4 of connector 0324 on LSP, diagram A3) is detected by the HOP (pos. 7301 on diagram B4). A bit will be set in the HOP. After filtering by the software, the set will switch to protection mode.

Error 3
Reserved.

Error 4
When the +5 V protection is active, the set is switched to protection and error code 4 is placed in the error buffer. The LED will blink 4 times (repeatedly). A 5 V failure can cause a drop in the 5 V supply output, resulting in an undefined behaviour of the set. Therefore, some I2C devices (Tuner and MSP) connected to the 5 V supply are constantly monitored. When none of these devices responds to the micro controller for a prolonged time, the micro controller assumes that there is a failure in the 5 V supply. By starting up the set via grounding of the FRONT_DETECT-line (on the side I/O), the +5 V protection will be overruled and it will be easier to determine the cause. The +5V protection will be activated when these I2C devices fail (no I2C communication):
– Main Tuner (pos. 1200 on the LSP),
– MSP34xx sound processor (pos. 7651 on the SSB).

The following tips are useful to isolate the problem area, after overriding the +5 V protection. Determine whether:
– The MSP sound processor is loading the +5 V; isolate 3650 and/or 4604 (see diagram B6).
– The main Tuner is loading the +5 V source; isolate coil 5200.

Caution! Overriding the +5 V protection when there is a 5 V failure can increase the temperature in the set and may cause permanent damage to components. Do not override the +5V-protection for a prolonged time.

Error 5

This error is covered by the Flash/Main routine described at error 7. When during restart the 8 V remains absent, error 5 will be generated.

Error 6
This will occur in the following cases:
– SCL or SDA is shorted to ground.
– SCL is shorted to SDA.
– SDA or SCL connection at the micro controller is open circuit.

Error 7
Flash detection: From the EHT-info, via D6303 and T7303 a flash will stop the H-drive and line output stage immediately. The FLS-bit in the status register of the HOP is set to 'high'. As the duration of a flash is very short the FLS-bit will be reset to 'low' again after the flash refresh, so via a slow start the set will be started again. If this interrupt occurs 5 times within an interval of 10 seconds (indicating a mains interruption), the set will go into protection and will generate error 7.

Error 10
Non Volatile Memory (EEPROM - pos. 7012) does not respond to the micro controller.

Error 11
During the last start-up, the NVM and the micro controller did not recognise each other (e.g. one of them was replaced or the NVM memory has been changed/adapted or lost), therefore the NVM was loaded with default values.

Error 12
Microprocessor (Painter - pos. 7001) internal RAM test failure.

Error 13
Tuner (pos. 1200) is corrupted, the I^2C line to the tuner is low, or there is no supply voltage at pins 7, 4 and 5 of the tuner.

Error 14
Sound controller MSP34xx (pos. 7651) does not respond to the micro controller.

Error 15
SRAM test failure (pos. 7011).

Error 16
The Tuner (pos. 7201) on the PIP/DW-panel does not respond to the micro controller.

Error 17
Multi PIP IC SAB9081 I^2C communication failure (pos. 7801 on the PIP/DW-panel).

Error 18
I/O expander IC M62320P I^2C communication failure (pos. 7403 on the PIP/DW-panel).

Error 23
BOCMA IC TDA888xx I^2C communication failure (pos. 7301 on the PIP/DW-panel).

Error 27
Virtual Dolby IC error.

Error 30
TDA 9320 HIP I/O-video processing (pos. 7323 on the SSB).

Error 31
SAA4978 PICNIC error (pos. 7709 on the SSB).

Error 32
TDA 9330 HOP video control/geometry error (pos. 7301 on the SSB).

Note:
Error codes 1, 2 and 4 are protection codes and in this case supplies of some circuits will be switched off. Also in protection, the LED will blink the number of times equivalent to the most recent error code.

5.6 The 'blinking LED' procedure

The contents of the error buffer can also be made visible through the 'blinking LED' procedure. This is especially useful when there is no picture.

When the SDM is entered, the LED will blink the contents of the error-buffer. Error-codes ≥ 10 are shown as follows. A long blink of 750 msec. which is an indication of the decimal digit, followed by a pause of 1500 msec, followed by n short blinks. When all the error-codes are displayed, the sequence is finished with a LED display of 3 seconds. Then the sequence starts again.

Example:
Error code position 1 2 3 4 5
Error buffer: 12 9 6 0 0
After entering SDM: 1 long blink (750 ms.) - pause (1500 ms.) - 2 short blinks - pause (3 s.) - 9 short blinks - pause (3 s.) - 6 short blinks - pause (3 s.) - long blink (3 s.) - etc.

Note: If errors 1, 2 or 4 occur, the LED ***always*** gives the last occurred error, even if the set is NOT in service mode.

5.7 Protections

5.7.1 General

The EM1A has only one microprocessor (Painter) which remains active during Standby. This because power of the microprocessor and the memories is coming from the 3V3 supply, which is derived from the 5V Standby-circuitry. So in both Power-on as in Standby-mode the microprocessor is connected to this power supply.

If a fault situation is detected an error code will be generated and if necessary the set will be put in the protection-mode. The protection-mode is indicated by blinking of the red LED at a frequency of 3 Hz. In some error cases the microprocessor does not put the set in the protection-mode. The error codes of the error buffer can be read via the service-menu (SAM), the blinking LED procedure or via DST/ComPair. The DST diagnose functionality will force the set into the Service-standby, which is alike the usual Standby, however the microprocessor has to remain in normal operation completely.

To get a quick diagnosis the EM1A has 3 service-modes implemented:
- The Customer Service Mode (CSM).
- The Service Default Mode (SDM). Start-up of the set in a predefined way.
- The Service Alignment Mode (SAM). In this mode items of the set can be adjusted via a menu and with the help of test patterns.

The 'Protection Diagram' shows the structure of the protection system. See diagram below.

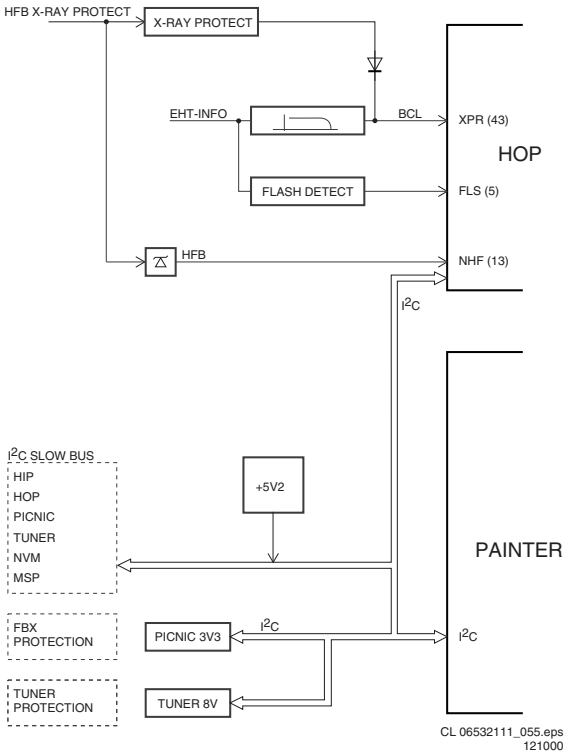


Figure 5-6

There are several types of protections:
- I2C related protections (e.g. +5V supply check).
- HOP related protections (mainly for deflection items).
- Hardware errors which are not sensed by the Painter (e.g. BRIDGE_PROT)

I2C related protections
In normal operation some registers of the I2C controlled IC's will be refreshed every 200 msec. During this sequence the I2C-busses and the I2C -IC's as well will be checked. The I2C protection will take place if the SDA and SCL are whether short-circuited to ground or to each other. An I2C error can also occur, if the power supply of the IC is missing (e.g. FBX_PROT; error 1).

HOP related protections
Every 200 msec. the status register of the HOP is read by the Painter via I2C. If a protection signal is detected on one of the inputs of the HOP, then the relevant error bit in the HOP register is set to 'high'. If the error bit is still 'high' after 1 sec., the Painter will store the error code in the error buffer (NVM) and depending on the relevancy of the error bit the set will either go into the protection-mode or not.
- HFB: Horizontal Flyback. If the horizontal flyback is not present, then this is detected via the HOP (HFB_X-RAY_PROT). One status bit is set to 'high'. The error code is stored in the error buffer and the set will go into the protection mode
- Flash detection. From the EHT-info, via D6303 and T7303 a flash will stop the H-drive and line output stage immediately. The FLS-bit in the status register of the HOP is set to 'high'. As the duration of a flash is very short the FLS-bit will be reset to 'low' again after the flash refresh, so via a slow start the set will be started again.

Hardware related protections
Due to the architecture (with 'hot' deflection) there are two protections that are 'unknown' to the microprocessor, namely the 'BRIDGE_PROT' (coming from the line stage) and the 'DEFL_PROT' protection (coming from the frame deflection stage). If one of these protections is triggered, the set is positioned in 'Standby'-mode. The Painter will now try to re-start the set. If this will not succeed after 5 times (after ≈ 30 - 60 s.), the Painter will generate error 7 (this error can have several causes, such as a Flash, BRIDGE_PROT, DEFL_PROT or a serious mains dip). A blinking red LED will be started.

5.8 Repair tips

5.8.1 General

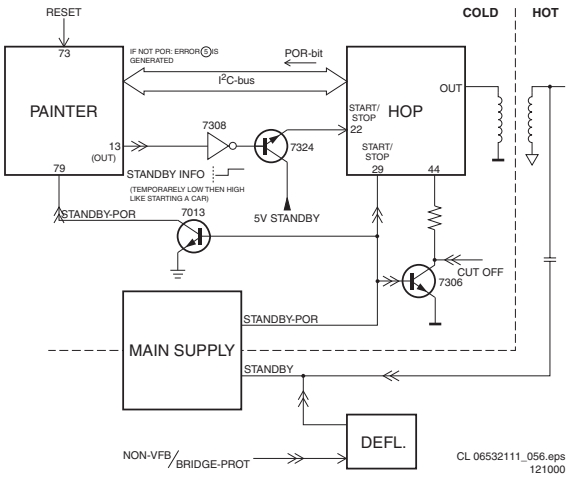


Figure 5-7

The start-up of the set is very different as of other sets (see fig. 5-7 & 5-8):
1. When the set is switched 'ON', first the HOP is placed in 'low power start-up' mode (HOP-standby-mode). This means that 5 V (derived from available Standby-supply) is connected to pin 22 of the HOP-IC.
2. Now the HOP is driving the line-circuitry with 50 kHz pulses. At the base of the line-transistor this is sensed via the 'STANDBY'-line.
3. This signal triggers the Main supply to operate. Now the line-stage has 'BAT'-voltage (141 V), it will also start.
4. After the 5 and 8 V-supply lines are sensed by the Painter (via I2C), it will read the POR-bit from the HOP via the I2C-bus.
5. Now the HOP is switched in 'ON'-mode and the set will start-up further with normal drive (31.25 kHz for PAL).
6. The last step will be the unblanking of the picture.

So standby is not controlled via a standby-line from microprocessor, but is achieved indirectly via the HOP-circuitry.

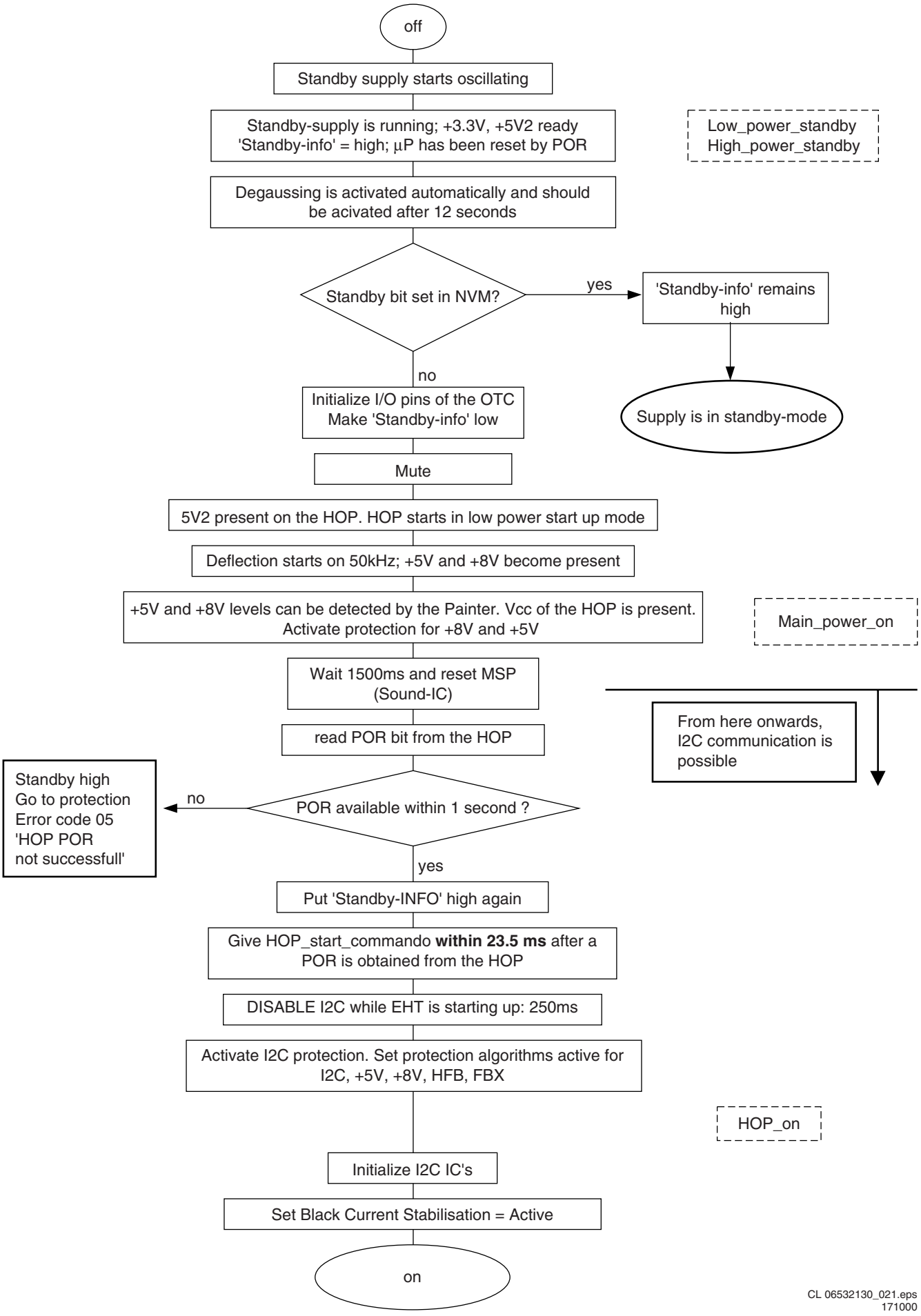

off
Standby supply starts oscillating
Standby-supply is running; +3.3V, +5V2 ready
'Standby-info' = high; µP has been reset by POR
Low_power_standby
High_power_standby
Degaussing is activated automatically and should be acivated after 12 seconds
Standby bit set in NVM?
yes
'Standby-info' remains high
Supply is in standby-mode
no
Initialize I/O pins of the OTC
Make 'Standby-info' low
Mute
5V2 present on the HOP. HOP starts in low power start up mode
Deflection starts on 50kHz; +5V and +8V become present
+5V and +8V levels can be detected by the Painter. Vcc of the HOP is present.
Activate protection for +8V and +5V
Main_power_on
Wait 1500ms and reset MSP (Sound-IC)
From here onwards, I2C communication is possible
read POR bit from the HOP
Standby high
Go to protection
Error code 05
'HOP POR not successfull'
no
POR available within 1 second ?
yes
Put 'Standby-INFO' high again
Give HOP_start_commando within 23.5 ms after a POR is obtained from the HOP
DISABLE I2C while EHT is starting up: 250ms
Activate I2C protection. Set protection algorithms active for I2C, +5V, +8V, HFB, FBX
HOP_on
Initialize I2C IC's
Set Black Current Stabilisation = Active
on
CL 06532130_021.eps
171000

Figure 5-8

- Notice that a very big part of the set (Large Signal Panel) is 'hot', meaning the primary part of the Standby supply, the whole Main supply (except for the secondary Audio supply) and the complete deflection circuit. **So notice that the deflection-coil is hot!**
- This set does not have an IR transmitting-LED. In its place, a Service (ComPair) connector is implemented at the rear of the set, which is directly accessible. In addition to this, there is a blinking LED procedure to show the contents of the error buffer.
- The relay you hear during switching 'ON' (via the main switch) is from the degaussing-circuitry. So it is not used for switching the supply as in the MG-chassis.
- When there is a menu in the picture, entry of service-modes cannot be performed. So see to it that there is no menu on the picture.

5.8.2 Repair tips

'Repair-tips how to repair the Main power supply:

- Simplest way is to replace components of the Main supply with repair kit (3122 785 90260)
- More detailed way:
  - Replace FET 7504 and zener 6505
  - Remove SSB-panel
  - Short-circuit BE of TS7529 in order to put supply in 'on'-mode (TS7529 is blocking then)
  - Load capacitor C2515 (VBAT) with a load of 500 ohm. Supply can not work without a minimum load.
  - Use a variac to slowly increase the VMAINS. Measure over sensing-resistors R3514/15 whether a nice sawtooth-voltage becomes available. Also measure the VBAT-output
  - VBAT may never exceed 141 V. If so there is something wrong in the feedback-circuitry (e.g. regulator 7506)

Repair-tips how to repair the Standby power supply:

- Simplest way is to replace components of the Standby supply with repair kit (3122 785 90270)

Repair-tips how to repair the Deflection-circuitry:

- Simplest way is to replace components of the Deflection-circuitry with repair kit (3122 785 90120)

Service-tips:

- Be careful measuring on gate of FET 7504. Circuitry is very high ohmic and can easily be damaged.
- Take care not to touch 'hot' heatsink while disconnecting SSB, despite the fact that mains cord is out of mains socket. There still is an annoying rest-voltage for a short while.
- Do not try to measure on side of SSB directed to the hot heatsink. This is dangerous. All service test points are guided to the Tuner side and are pointed out by service printing. Where the circuitry was too crowded to place this service-printing it has been explained on the Test point overviews in this manual

Phenomenon	Possible Cause	Repair tip
No picture, no LED.	Standby Supply defective.	Measure circuitry (see diagram A2). Start at test-point P16. Regardless the mode of the set, this voltage should always be available.
No picture, red LED (high intensity). Despite expectation, the set should be ON (this looks like Standby). After some time LED will start blinking.	There are 2 protections (which are not 'seen' by the processor) that force the set in protection (after 5 restart attempts): BRIDGE_PROT or MAINS DIP error.	If protection is activated due to an absence of the Frame deflection, this can be measured on test-point F10 (diagr. A4). Error 33 will be generated. The BRIDGE_PROT could be triggered by an E/W failure. An MAINS_DIP error (error 7) will be generated in both cases after 5 restart attempts, and will be visible via the blinking LED procedure. ComPair is very useful here.
Set going into protection after 5 restarts (error 7), taking about 30 - 60 s.	180 V missing on CRT-panel (diagr. F). Most probably R3341 is interrupted, or RGB-amplifier IC7307 is defective.	Measure 180 V behind R3341 (diagr. F) while operating, or measure resistance of R3341 while set is of.
No picture, red LED blinking (3 Hz)	Set is in protection due to various causes. For error codes see error code list.	You have no picture, so: Read out the error buffer via ComPair. Read out blinking LED information via 'DIAGNOSE X' with DST. When error is known, check circuitry related to supply voltage and I^2C - communication.
No picture, red LED blinking (code 6, 6, 6)	No communication on I^2C1-bus ('devices' bus) to processor. Set is in protection-mode	Measure, dependent of the error, on the I^2C-bus which device is loading the bus. This protection can be overruled via SDM-entry (via short-circuiting FRONT_DETECT to GND on Side I/O).
No picture, red LED blinking (code 10, 10, 10)	No communication on I^2C3-bus ('NVM' bus) to processor. Set is in protection-mode	No contact of processor with the NVM. A lot of settings will therefore be wrong.
No picture, no sound, set is making audible squeaking sound	Supply could be in hiccup-mode which can be heard via supply-transformer squeaking	This could be caused by: Short-circuited V_{BAT} (caused by short circuited line transistor 7421) or Short-circuited sound-winding (amplifier is short-circuiting 28 V) or Short-circuited D6514 (due to a too high V_{BAT}). Delete excessive load to see where failure is caused by or check feed back circuit. See repair-tip main power supply (supply needs a minimal load).
No picture, no sound, LED works fine	Supply does not work correctly	If e.g. V_{BAT} is only about 90 V, regulator-IC 7506 could be damaged.
No RC5-reception. Red LED does not echo RC-commands.	Processor-circuitry or RC-receiver is wrong.	In case set reacts on local keyboard operation, error must be found in the IR-receiver circuitry (diagram J).
Relay-activation (degaussing) not audible when switch set on from off .	Processor not working correctly.	Check RESET-circuitry on diagram B5. When switching on the set all I/o-pins of processor should become high for a moment, so also the degauss-input signal.
No sound, but picture.	Measure P7 on diagram A1. Possible sound-amplifier is defect (but not short-circuited), or sound-enable line is high (see diagram A5). Further the audio-signal path must be measured (HIP, MSP, switch-IC s, amplifier).	Measure and repair. With ComPair there is a beep-test that can determine where the signal stops (use loudspeakers, headphone).
No sound at headphone output.	Discrete amplifiers or supply to it could be damaged.	Measure A12, A13, A14, A15 and supply-line on diagram A6.
Picture is rotated.	Rotation-circuitry or supply to it could be damaged (if present).	Measure test-points F3, R1, R2 on diagram A4.
No picture.	Check functionality and cabling Tuner to SSB.	Notice cable 1946.
Picture looks like cushion, further OK	Or NVM-content is overwritten or E/W-MOSFET is short-circuited	First check in Service Alignment Mode, whether geometry can be restored. If not check test point L4 and diagram A3, or measure with an ohmmeter whether TS7480 is defective.
Very white picture, with flyback lines visible	180 V is missing on CRT-panel	Probably R3468 on LSP (diagram A3) is interrupted, or bad connection plug 0324 to 0224 (CRT-panel).
Un-sharp picture	Focus could be misaligned or SCAVEM-circuitry does not work correctly	Align focus-potmeter of Line Transformer; check SCAVEM-circuitry on CRT-panel [F].
Un-synced picture	Sync is derived in HIP-IC from X-tals 1309 and/or 1310	Maybe an X-tal is making bad contact.
Picture distorted.	Check video-path, service default mode.	Investigate whether there exists an error code in the error buffer. In case there is an error code, check I^2C-bus and/or supply-lines (see overview supply-lines). Measure and check signal path Tuner, HIP, PICNIC, HOP, RGB-amplifier. In case it is a geometry-issue, check Frame-circuitry, alignments or possible corrupted NVM (7012)
No menu, OSD.	Probably processor is defective.	Measure test points C7, C8, C9, C10 on diagram B7.

CL 06532111_057.EPS
121000

Personal notes:

8. Alignments

Note: The Service Default Mode (SDM) and Service Alignment Mode (SAM) are described in chapter 5.

8.1 General alignment conditions

All electrical adjustments should be performed under the following conditions:

- Supply voltage: 110 / 220 V (± 10 %); 50 / 60 Hz (± 5 %)
- Warm-up time: ≈ 20 minutes
- The voltages and oscillograms are measured in relation to the tuner earth (with exception to the voltages on the primary side of the power supply). Never use the cooling fins / plates as ground.
- Test probe: Ri > 10 MΩ; Ci < 2.5 pF.
- Use an **isolated** trimmer / screwdriver for the alignments.

8.2 Alignments on the large signal panel (LSP)

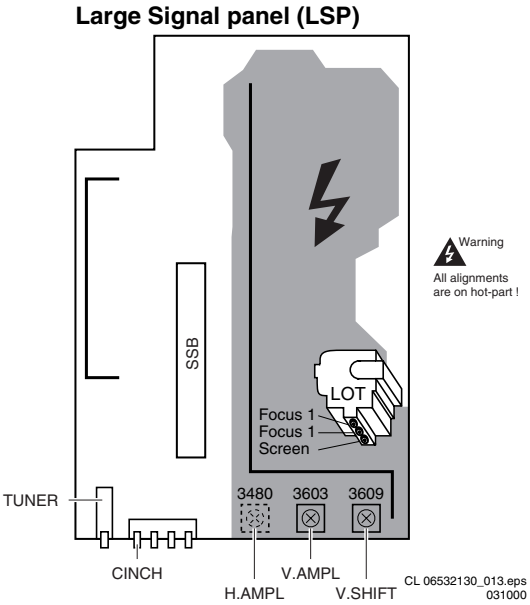


Figure 8-1

8.2.1 Vg2 adjustment

Rough method

Using a pattern generator displaying a black pattern (PAL BG, 475.25 MHz), adjust the Vg2 potmeter of LOT (item 5430) to obtain normal picture (without visible fly-back lines).

Accurate method

1. Connect the RF output of the pattern generator to the antenna-input of the TV. Test pattern is a 'black' pattern (blank screen on CRT **without** any OSD info).
2. Set the channel of the oscilloscope to 50 V/div and the time base to 5 ms. Select 'external triggering' on the vertical pulse (anode of diode 6619, located near connector 0325 to frame deflection coil).
3. Measure the black level pulse during the vertical flyback (1st full line after the frame blanking) at the R, G and B cathodes of the CRT (pin 8, 6 and 11 of the CRT connector). Select the cathode with the highest V_{DC} value for the measurement.
4. Adjust Vcutoff with the Vg2 (SCREEN) potmeter of the LOT to 170 ± 2 V_{DC}.

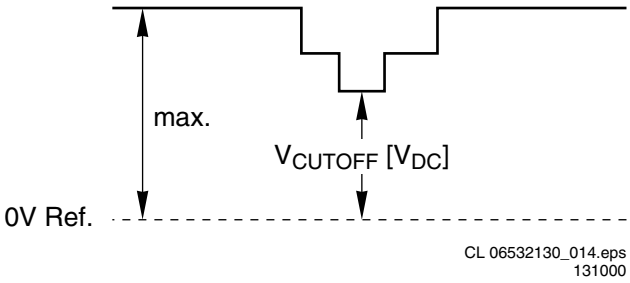


Figure 8-2

8.2.2 Focusing

1. Tune the set to a circle or crosshatch test pattern (use an external video pattern generator).
2. Adjust the 1st Focus potmeter (upper LOT potmeter, see figure 8-1) until the horizontal and vertical lines at 1/4 from east and west, at the height of the centre line, are of minimum width without visible haze.
3. Adjust the 2nd Focus potmeter (middle LOT potmeter, see figure 8-1) until the horizontal and vertical lines at 1/4 from north and south, at the height of the centre line, are of minimum width without visible haze.

8.3 Alignments and settings in the Service Alignment Menu

8.3.1 General

With the software alignments of the Service Alignment Mode the Geometry, White tone and Tuner (IF)can be aligned. Put the set in the SAM mode (see chapter 5). The SAM menu will now appear on the screen.
Menu navigation is done with the 'CURSOR UP, DOWN, LEFT or RIGHT' keys of the RC-handset.

8.3.2 Geometry

The geometry alignments menu contains several items to align the set, in order to obtain a correct picture geometry.

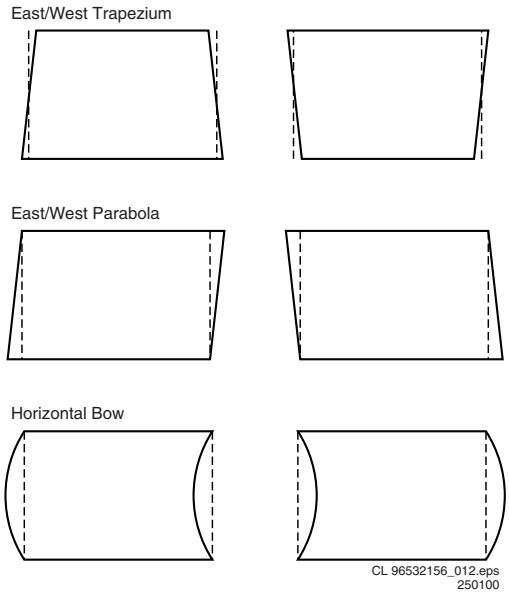


Figure 8-3

Initial set-up

1. Connect an external video pattern generator (PAL BG, 475.25 MHz) to the aerial input of the TV-set with a crosshatch test pattern.
2. Set 'Smart Picture' to NATURAL.
3. Activate the SAM-menu (see chapter 5).
4. Go to sub-menu GEOMETRY. Now the following alignments can be performed:

Vertical slope (VER. SLOPE)
Align the vertical centre of the picture to the vertical centre of the CRT.This is the first alignment to be performed of the vertical alignments. For an easy alignment set SERV.BLK to ON.

Service blanking (SERV. BLK)
Switch the blanking of the lower half of the screen ON/OFF (to be used in combination with the vertical slope alignment).

Vertical amplitude alignment
Align the vertical amplitude with potentiometer R3603 on the LSP (see Fig. 8-1) so that the complete test pattern is visible.

Vertical shift alignment
Align the vertical centering with potentiometer R3609 on the LSP (see Fig. 8-1) so that the test pattern is located vertically in the middle. Repeat the 'vertical amplitude' alignment if necessary.

Horizontal shift (HOR. SHIFT)
Align the horizontal centre of the picture to the horizontal centre of the CRT.

Horizontal bow (HOR. BOW)
Align straight horizontal lines in the top and the bottom; horizontal rotation around the centre.

Horizontal parallelogram (HOR. PARALLEL)
Align straight vertical lines in the top and the bottom; vertical rotation around the centre.

East West width (EW. WIDTH)
Align the picture width until the complete test pattern is visible.

East West parabola (EW. PARA)
Align straight vertical lines at the sides of the screen.

East West Trapezium (EW. TRAP)
Align straight vertical lines in the middle of the screen.

East West Upper Corner (EW. UCORN)
Align straight vertical lines in the upper corners of the screen.

East West Lower Corner (EW. LCORN)
Align straight vertical lines in the lower corners of the screen.

8.3.3 Tuner (Large Signal Panel and Double Window)

Note: Described alignments are only necessary when HIP or NVM is changed.

IF PLL OFFSET
Supply, via a video generator (e.g. PM5518), a TV-signal (e.g. colour bar) with a signal-strength of at least 1 mV and a frequency of 471.25 MHz (use BG if possible, otherwise match the system of your generator with the received signal in the set).
Alignment procedure:

1. Go to the 'Installation' menu.
2. Select 'Manual installation'.
3. Tune the TV-set to the system and frequency described above via 'Search' - '471' - 'OK'.
4. If the frequency showed in the line 'Fine tune' is between 471.18 MHz and 471.31 MHz, you don't need to re-adjust the IF-AFC.
5. If not, adjust the frequency in the 'Fine tune' line to 471.25 MHz and store the program by leaving the menu (this is very important because this will disable the AFC algorythm).
6. Now go to the SAM and select 'Alignments' - 'General' - 'IF AFC'.
7. First you must align the 'IF AFC'-parameter such that you come into the AFC-window (AFA = 1)
8. Then you must look for the point where the AFB-parameter changes from 1 to 0. This level is the value you are looking for.
9. After adjustment store the value by returning to the former menu.
10. Now return to the 'Installation' menu.
11. Select 'Manual Installation' - 'Search' - '47' - 'OK' and store it. This will set the AFC 'on' again.
12. During the 'IF PLL'-parameter adjustment, one can see feedback at the screen, by means of the 'AFA' and 'AFB' indication (see table).

AFA	AFB	IF-PLL offset
0	0	Decrease offset value
0	1	Increase off-set value
1	0	Correct
1	1	Correct

AGC
Set pattern generator (e.g. PM5418) to a colour bar video signal and connect the RF output to aerial input. Set amplitude to at least 1 mV and set frequency for PAL-BG to 471.25 MHz.

1. Activate the SAM-menu. Go to the sub-menu TUNER, and select the '**AGC**' sub-menu.
2. Connect a DC multi-meter to pin 1 of the tuner (item 1200 on LSP).
3. Adjust the AGC until the voltage at pin 1 of the Tuner is just below 3.8 V.
4. The value can be incremented or decremented by pressing the MENU LEFT/RIGHT button on the RC.
5. Switch the set to STANDBY.

2ND AGC
Set pattern generator (e.g. PM5418) to a colour bar video signal and connect the RF output to aerial input. Set amplitude to at least 1 mV and set frequency for PAL-BG to 471.25 MHz.

1. Activate the SAM-menu. Go to the sub-menu TUNER, and select the **'2nd AGC**' sub-menu.
2. Connect a DC multi-meter to pin 1 of the tuner (7201 on DW panel).
3. Adjust the 2nd AGC until the voltage at pin 1 of the Tuner is just below 3.8 V.
4. The value can be incremented or decremented by pressing the MENU LEFT/RIGHT button on the RC.
5. Switch the set to STANDBY.

8.3.4 Black cut off

In the WHITE TONE sub menu, the values of the black cut off level can be adjusted. The colour temperature mode (NORMAL, DELTA COOL, DELTA WARM) or the colour (R, G, B) can be selected with the UP/DOWN RIGHT/LEFT cursor keys. The value can be changed with the RIGHT/ LEFT cursor keys.
First the values for the NORMAL colour temperature should be selected. Then the offset values for the DELTA COOL and DELTA WARM mode can be selected (note that the alignment values are non-linear).

- +1 to +63 represent a positive offset (63 is the maximum positive offset).

- -63 to -1 represent a negative offset (-63 is the minimum negative offset).

1. Set pattern generator (e.g. PM5418) to a white spot (chess board) pattern and connect RF output with aerial input. Set amplitude to 1 mV and set frequency for PAL-BG to 475.25 MHz.
2. Set CONTRAST to the maximum value (99).
3. NORMAL settings
   – NORMAL RED = 32
   – NORMAL GREEN = 32
   – NORMAL BLUE =32
4. COOL settings
   – DELTA COOL RED = -3
   – DELTA COOL GREEN = 0
   – DELTA COOL BLUE = 3
5. WARM settings
   – DELTA WARM RED = 4
   – DELTA WARM GREEN = 0
   – DELTA WARM BLUE = -8
6. CUT OFF (default) settings
   – BLACK LEVEL R = 7
   – BLACK LEVEL G = 7
7. Measure with a colour analyser (calibrated with the spectra) on the centre of a white square on the screen. Adjust the values of BLACK LEVEL R and BLACK LEVEL G to get the right XY-coordinates for Tint = Normal (see table 8-1).

Note: When there is no colour analyser available, use the default settings mentioned above.

8.3.5 Light output

In the WHITE TONE sub menu, also the light output of the CRT can be adjusted. In this case a colour analyser is necessary.

1. Set pattern generator (e.g. PM5418) to a white spot pattern and connect RF output to aerial input. Set amplitude to 1 mV and set frequency for PAL-BG to 475.25 MHz.
2. Set CONTRAST to the maximum value (99).
3. Measure with a colour analyser (calibrated with the spectra) on the centre of the white square on the screen. Adjust the level of NORMAL RED, NORMAL GREEN and NORMAL BLUE in a simultaneous way to get the 360 cd light output.

8.3.6 White drive

In the WHITE TONE sub menu, the values of the WHITE DRIVE level can be adjusted. The colour temperature mode (NORMAL, DELTA COOL, DELTA WARM) or the colour (R, G, B) can be selected with the UP/DOWN RIGHT/LEFT cursor keys. The value can be changed with the RIGHT/ LEFT cursor keys.

1. Set pattern generator (e.g. PM5418) to a white spot pattern and connect RF output to aerial input. Set amplitude to 1 mV_{RMS} and set frequency for PAL-BG to 475.25 MHz.
2. Set CONTRAST to the maximum value (99).
3. Measure with a colour analyser (calibrated with the spectra) on the centre of the white square on the screen. Adjust the level of NORMAL BLUE and NORMAL RED to get the right XY-coordinates. See table 8-1.

Table 8-1

Tint	Temperature (K)	X	Y
Warm	8700	289	299
Normal	13500	266	274
Cool	18300	256	264

8.4 Options

8.4.1 Options

Options are used to control the presence / absence of certain features and hardware. There are two ways to change the option settings (see also fig. 8-3):

Changing a single option
An option can be selected with the MENU UP/DOWN keys and its setting can be changed with the MENU LEFT/RIGHT keys.
Changes in the option settings are saved by leaving the OPTION submenu. Some changes will only take affect after the set has been switched OFF and ON with the mains switch (cold start).

Changing multiple options by changing option byte values
Changing the option bytes directly, makes it possible to set all options very fast. An option byte (OB1..8) can be selected with the MENU UP/DOWN keys and its setting can be changed with the MENU LEFT/RIGHT keys. An option byte represents a number of different options. All options of the EM1A are controlled via 8 option bytes. Select the option byte (OB1..OB8) and key in the new value.
Changes in the option byte settings are saved by leaving the OPTION submenu. Some changes will only take affect after the set has been switched OFF and ON with the mains switch (cold start).

Option bits/bytes
An option byte value is calculated in the following way:
Value 'option bit 1' x 1 =
Value 'option bit 2' x 2 =
Value 'option bit 3' x 4 =
Value 'option bit 4' x 8 =
Value 'option bit 5' x 16 =
Value 'option bit 6' x 32 =
Value 'option bit 7' x 64 =
Value 'option bit 8' x 128 =
==========
Total: value 'option byte' =

2 Software versions are used: 1A1 and 2A1/2A2. Below find, in table 8-2 and 8-3, the option definition for both versions (for an explanation of the SW-version versus country code see table in chapter 5.2.2, page 16).

Option table (version 1A1):

Table 8-2

Byte	Bit	Abbr.	Feature	Description (OFF = 0, ON = 1)
OB1	1	AUSB	Auto Standby After 2hrs	OFF = function disabled / ON= function enabled
OB1	2	AV3	Side AV source	OFF = side AV source not available / ON = available
OB1	3	HOSP	Hospitality mode	OFF = hospital mode disabled / ON = enabled
OB1	4	E149	Picture setting for expand 14:9	OFF = not available in FORMAT menu / ON = available
OB1	5	C169	Pict. setting for compress 16:9	OFF = not available in FORMAT menu / ON = available
OB1	6	CVI	External source selection for PIP	OFF = disabled / ON = enabled
OB1	7	SBNP	Auto Standby with no picture	OFF = no switch to stdby / ON= switch to stdby after 10m. when no ident
OB1	8	ASBY	Auto Standby After 2 hours	OFF = disabled / ON = active after 2 hrs of no RC or keyboard response
OB2	1	PIPC	PIP Control	OFF = disabled / ON = enabled
OB2	2	BLMU	Blue Mute	OFF = disabled / ON = enabled
OB2	3	SOSD	Smart OSD	OFF = full display of OSD not available / ON = available
OB2	4	PLST	Program List	OFF = access to Command is ignored / ON = access is processed
OB2	5	PITN	Philips tuner	OFF = ALPS compatible tuner used / ON= Philips compatible tuner used
OB2	6	VDBY	Virtual Dolby	OFF = Virtual Dolby not available / ON = Virtual Dolby is available
OB2	7	IPMU	Incredible picture via menu	OFF = menu item 'INCR. PICT' not available / ON = available
OB2	8	CBFL	Comb filter	OFF = no comb filter on the SSB / ON = comb filter present on the SSB
OB3	1	SURF	Surf	OFF = disabled / ON = enabled
OB3	2	CHNA	China set	OFF = disabled / ON = enabled
OB3	3	VSLC	Vertical slicing	OFF = disabled / ON = enabled
OB3	4	W169	Double Window 16:9	OFF = disabled / ON = enabled
OB3	5	W4X3	Double Window 4:3	OFF = disabled / ON = enabled
OB3	6	PIPF	PIP Functionality	OFF = disabled / ON = enabled
OB3	7	PIPT	PIP Tuner	OFF = disabled / ON = enabled
OB3	8	PIPS	PIP Surf	OFF = disabled / ON = enabled
OB4	1	APC	Auto Picture Control	OFF = Time Window is set to 2 s. / ON = Time window is set to 5 s.
OB4	2	INCF	Internal Combfilter	OFF = disabled / ON = enabled
OB4	3	TMWIN	Time Window	OFF = Time Window is set to 2 s. / ON = Time window is set to 5 s.
OB4	4	SNIC	Sound IC MSP3451	OFF = sound IC MSP3451 not present / ON = present
OB4	5	ROTI	Rotation tilt	OFF = menu item 'ROTATION' not available / ON = available
OB4	6	CHLK	Child Lock	OFF = function disabled / ON = enabled
OB4	7	AAVL	Automatic Volume Leveller	OFF = menu item 'AVL' not available / ON = menu item available
OB4	8	TIME	Timer	OFF = disabled / ON = enabled
OB5	1	N/A	(RESERVED)	N/A
OB5	2	N/A	(RESERVED)	N/A
OB5	3	N/A	(RESERVED)	N/A
OB5	4	N/A	(RESERVED)	N/A
OB5	5	N/A	(RESERVED)	N/A
OB5	6	N/A	(RESERVED)	N/A
OB5	7	N/A	(RESERVED)	N/A
OB5	8	PAGC	PICNIC AGC	OFF = disabled / ON = enabled
OB6	1..8	N/A	(RESERVED)	N/A
OB7	1..8	N/A	(RESERVED)	N/A
OB8	1..8	N/A	(RESERVED)	N/A

Option table (version 2A1 / 2A2):

Table 8-3

Byte	Bit	Abbr.	Feature	Description (OFF = 0, ON = 1)
OB1	1	AV3	Side AV source	OFF = side AV source not available / ON = available
OB1	2	SMCK	Smart clock	OFF = function disabled / ON= function enabled
OB1	3	HOSP	Hospitality mode	OFF = hospital mode disabled / ON = enabled
OB1	4	E149	Picture setting for expand 14:9	OFF = not available in FORMAT menu / ON = available
OB1	5	C169	Pict. setting for compress 16:9	OFF = not available in FORMAT menu / ON = available
OB1	6	CVI	External source selection for PIP	OFF = function disabled / ON= function enabled
OB1	7	SBNP	Auto Standby with no picture	OFF = no switch to stdby / ON= switch to stdby after 10m. when no ident
OB1	8	ASBY	Auto Standby After 2 hours	OFF = disabled / ON = active after 2 hrs of no RC or keyboard response
OB2	1	SOSD	Smart OSD	OFF = full display of OSD not available / ON = available
OB2	2	PLST	Program List	OFF = access to Command is ignored / ON = access is processed
OB2	3	PITN	Philips tuner	OFF = ALPS compatible tuner used / ON= Philips compatible tuner used
OB2	4	VDBY	Virtual Dolby	OFF = Virtual Dolby not available / ON = Virtual Dolby is available
OB2	5	NTSC	NTSC playback	OFF = not possible via EXT-in / ON= function enabled
OB2	6	IPMU	Incredible picture via menu	OFF = menu item 'INCR. PICT' not available / ON = available
OB2	7	CBFL	Comb filter	OFF = no comb filter on the SSB / ON = comb filter present on the SSB
OB2	8	AUSB	Auto Standby auto on	OFF = function disabled / ON= function enabled
OB3	1	W4X3	Double Window 4:3	OFF = function disabled / ON= function enabled
OB3	2	ISUR	Incredible Surround	OFF = function disabled / ON= function enabled
OB3	3	PIPF	PIP Functionality	OFF = function disabled / ON= function enabled
OB3	4	PIPT	PIP Tuner	OFF = function disabled / ON= function enabled
OB3	5	PIPS	PIP Surf	OFF = function disabled / ON= function enabled
OB2	6	PIPC	PIP Control	OFF = function disabled / ON= function enabled
OB3	7	BLMU	Blue Mute	OFF = function disabled / ON= function enabled
OB3	8	FAPG	Favorite page	OFF = function disabled / ON= function enabled
OB4	1	CHLK	Child Lock	OFF = function disabled / ON= function enabled
OB4	2	AAVL	Automatic Volume Leveller	OFF = menu item 'AVL' not available / ON = menu item available
OB4	3	TIME	Timer	OFF = function disabled / ON= function enabled
OB4	4	DTXT	Double window TXT	OFF = function disabled / ON= function enabled
OB4	5	TXT	Teletext available	OFF = function disabled / ON= function enabled
OB4	6	SURF	Surf	OFF = function disabled / ON= function enabled
OB4	7	VSLC	Vertical slicing	OFF = function disabled / ON= function enabled
OB4	8	W169	Double Window 16:9	OFF = function disabled / ON= function enabled
OB5	1	N/A	(RESERVED)	N/A
OB5	2	N/A	(RESERVED)	N/A
OB5	3	APC	Auto Picture Control	OFF = disabled / ON = enabled
OB5	4	PAGC	PICNIC AGC	OFF = disabled / ON = enabled
OB5	5	INCF	Selection colour delay line	OFF = disabled / ON = enabled
OB5	6	TMWIN	Time Window	OFF = Time Window is set to 2 s. / ON = Time window is set to 5 s.
OB5	7	SNIC	Sound IC MSP3451	OFF = sound IC MSP3451 not present / ON = present
OB5	8	ROTI	Rotation tilt	OFF = menu item 'ROTATION' not available / ON = available
OB6	1..8	N/A	(RESERVED)	N/A
OB7	1..8	N/A	(RESERVED)	N/A
OB8	1..8	N/A	(RESERVED)	N/A

9. Circuit descriptions and abbreviation list

9.1 Circuit descriptions

The following circuits are described:
1. Introduction
2. Block diagrams
3. Power supply
4. Control & Teletext
5. Tuner & IF
6. Video: High-end Input Processor
7. Video: Feature box
8. Video: High-end Output Processor
9. Synchronisation
10. Horizontal deflection
11. Vertical deflection
12. Audio
13. CRT & SCAVEM
14. Double Window (DW)

9.1.1 Introduction

The EM1A is a lower specified MG-chassis. EM stands for Eco-MG, 1 for the used processor (Painter) and A stands for Asian Pacific.
The user interface and processor are the same as used in the A10A set. In the EM1A however, a HIP, PICNIC and HOP are used for the 100 Hz function i.s.o. the BOCMA in the A10A. So the HIP and HOP have the same functionality as the BOCMA (to let the set work in 2fH-mode), while the PICNIC is used for video features like AutoTV and Freeze.

The architecture consists of a conventional Large Signal Panel (LSP) a Double Window panel (DW) and a Small Signal Board (SSB) module, placed into a so-called SIMM-connector (Standard Interface, 80 pins).

The LSP is built up very conventional, with hardly any surface mounted components on the copper side. Difference with the MG-chassis is that the EM1A LSP has a very large 'hot' part, including the deflection coil.

The SSB is a high tech module (2 sides reflow technology, full SMC) with very high component density and complete shielding for EMC-reasons. Despite this, it is designed in such a way, that repair on component level will be possible. To achieve this, attention has been paid to:
- The position of service test lands (Tuner side).
- Accessibility (Tuner side).
- Clearance around surface mounted IC's (for replacing).
- Diagnostics & Fault Finding via ComPair.

Warning: Be aware that half of the LSP-circuitry is 'hot', including the deflection coil.

Protection: The start-up behaviour of the EM1A is different then that of the MG-chassis, meaning that there does not exist a situation as in the MG where we have 'supply ON/ deflection circuit OFF'.
This means that isolating failures in the EM1A must be done in a different way. See Chapter 5 of this manual.

9.1.2 Block diagrams

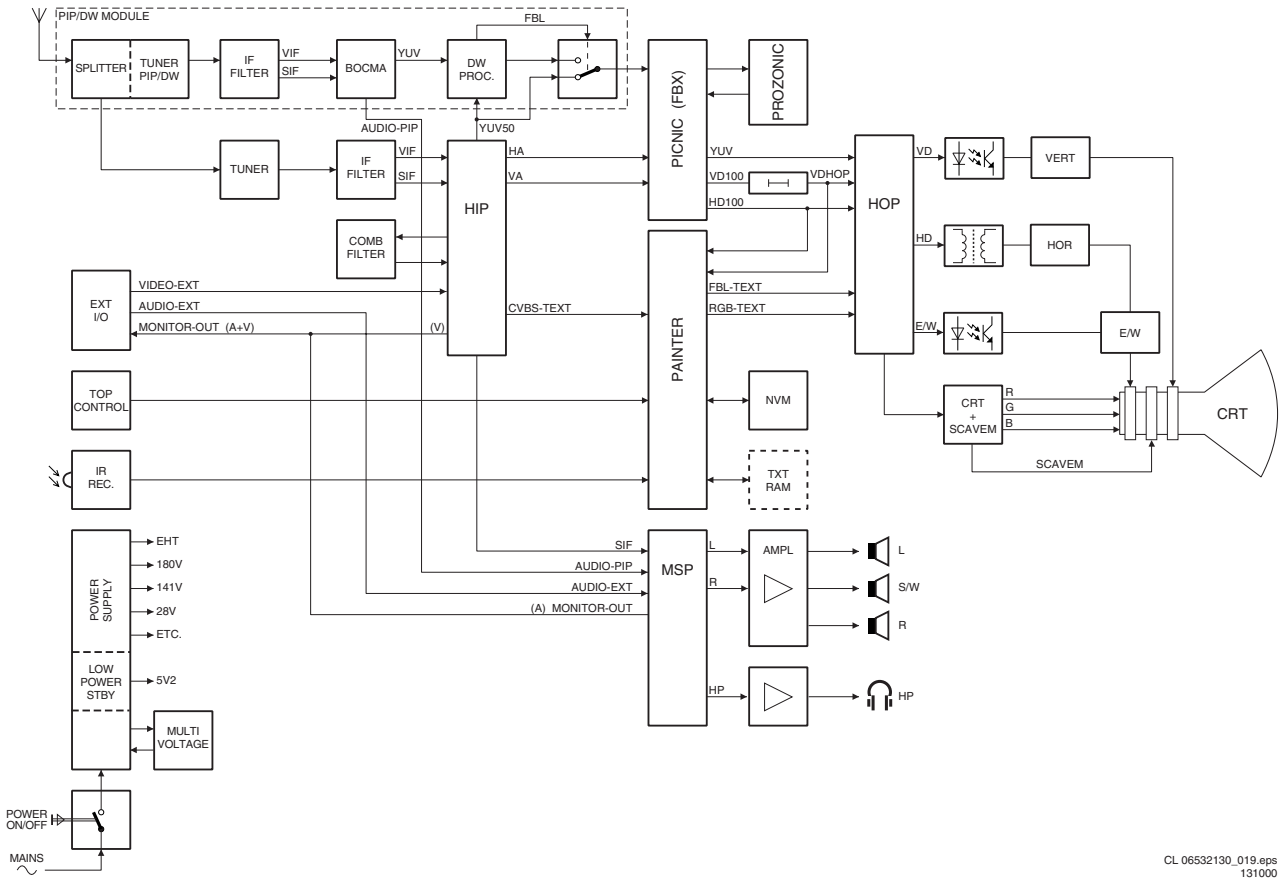


Figure 9-1

The tuner type is a PLL tuner and delivers the IF-signal, via audio & video SAW-filters, to the HIP (High-end Input Processor). The HIP has the following functions:
- IF modulation.
- Video source- and record select.
- Colour decoder.
- Synchronisation.

Two EXT-connectors can be used: AV1 is fully equipped and AV2 is meant for VCR. There is also a possibility for Y/C in. The MON-out can be used for WYSIWYR (What You See Is What You Record).

The HIP delivers the signal to the PICNIC. This IC takes care of:
- Analogue to Digital conversion and vice versa.
- 50 to 100 Hz conversion.
- Panorama mode.
- Noise reduction.
- Dynamic contrast.

For *Digital Scan* the PROZONIC is required, which can be connected to the PICNIC.

After the PICNIC the, now doubled, YUV- and H/V-signals are fed to the HOP (High-end Output Processor). This IC handles the video control and geometry part. The RGB-signals from TXT/OSD are also inserted via the HOP. The video part delivers the RGB signals to the CRT-panel and the geometry part delivers the H-drive, V-drive and also a drive-signal for rotation (as a variable DC-level on the V-drive signal).

Both deflection circuits are 'hot' and located on the LSP and are driven by the HOP. To make the galvanic separation, the line drive is driven via transformer 5410 and the framedrive via optocoupler 7610.The horizontal output stage generates some supply voltages, the EHT-, focus- and Vg2-voltages.

The RGB amplifiers on the CRT-panel are integrated in one IC and are supplied with 180 V from the LOT.
The SCAVEM circuit modulates transitions of the Luminance (Y) signal on the horizontal deflection current, giving a sharper picture.

The sound part is built around the MSP34xx (Multichannel Sound Processor) for IF sound detection, sound control and source selection. Amplification is done via an integrated power amplifier IC, the TDA2616.

The microprocessor, called Painter (OSD, Teletext and Control) takes care of the analogue TXT input- and output processing. The Painter processor and RAM (if present) are supplied with 3.3 V, which is derived from the +5VSTANDBY. The NVM (Non Volatile Memory) is used to store the settings, the Painter is an OTP (One Time Programmable) chip with programmed ROM-code and the (optional) DRAM is used for storing the Teletext pages.

In the EM1A there is a separate Standby Supply in order to reduce the Standby power consumption. During Standby, the Main Supply is switched off (via TS7529). A relay is used to switch the Degaussing circuit.
The Main Supply, a SOPS supply based on the 'down-converter' principle, generates the 141 V (VBAT) and the 28 V for the audio part.
Difference with former MG-sets is that VBAT is not mains isolated ('hot') and is alignment free.

9.1.3 Power supply (diagram A1 & A2)

General
The power supply has a number of main functions. These functions are dealt with in succession:
- Mains filter
- Degaussing picture tube
- Standby power supply
- Main supply

Mains filter (diagram A1)

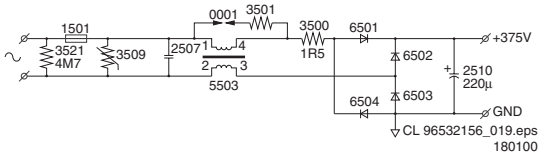


Figure 9-2

The mains filter has 2 functions: it prevents high-frequency signals to be transferred into the mains and it protects the set from lightning damage.

C2507 prevents the high-frequency signals, generated by the set, to be conveyed into the mains by short-circuiting them.

In case of a lightning surge between the 2 phases (differential mode) the energy is immediately bled away through the VDR (R3509) to the other phase.
In case of a lightning surge on both phases of the mains in relation to the aerial earth, the mains filter acts as a high resistance (UEMK=L * dI/dt) as a result of which the voltage across coil L5503/04 increases. A spark gap (0001) prevents that the voltage increases too much, which would lead to a damaged coil. When ignited, the current will be discharged via this spark gap.
The two networks using R3503//0002 and R3502//0003 are also used for lightning protection. They lead the energy of a common-mode lightning surge from the 'cold' to the 'hot' side in case of insertion on the aerial or from the 'hot' to the 'cold' side in case of insertion via the mains-input.
Resistor R3500 is used for limiting the inrush-current.

Degaussing picture tube (diagram A1)
After switching 'ON' the set via the mains switch, the DEGAUSS_INPUT signal from the processor (Painter) will be made high, transistor 7528 will conduct and relay 1002 will be activated. Initially a considerable current will flow, via PTC 3516, through the degaussing coil. The PTC will heat up, resistance will rise and the current will decay rapidly. The Painter will switch off the relay after 12 seconds.

Standby power supply (diagram A2)
This power supply is of a SOPS type (Self-Oscillating Power Supply) and is regulated by the controlled switching of an oscillator. It uses the so-called 'Flyback' principle:

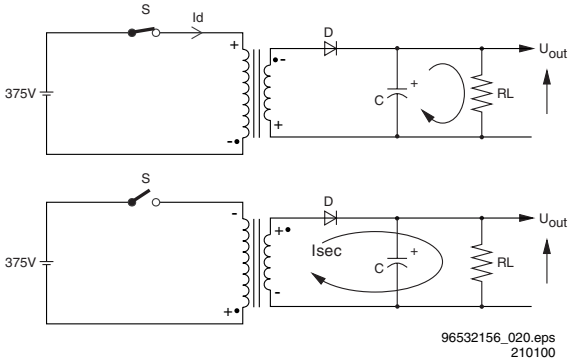


Figure 9-3

- After closing switch 'S', the current ID will increase linear in time. The magnetic energy in the primary coil is directly proportional with the self-inductance of the coil and current ID (thus with the time the switch is closed). The

voltage polarity at the secondary winding is negative (due to different winding direction), meaning that diode D will block. Capacitor C will discharge via RL, UOUT will decrease.

- Opening switch 'S' will generate a counter-e.m.f. in the primary winding, trying to maintain current ID. Through this the polarity of the secondary voltage will inverse. The magnetic energy, stored in the coil, will now be transformed to the secondary side. Diode D will now conduct, capacitor C will be charged and UOUT will increase.

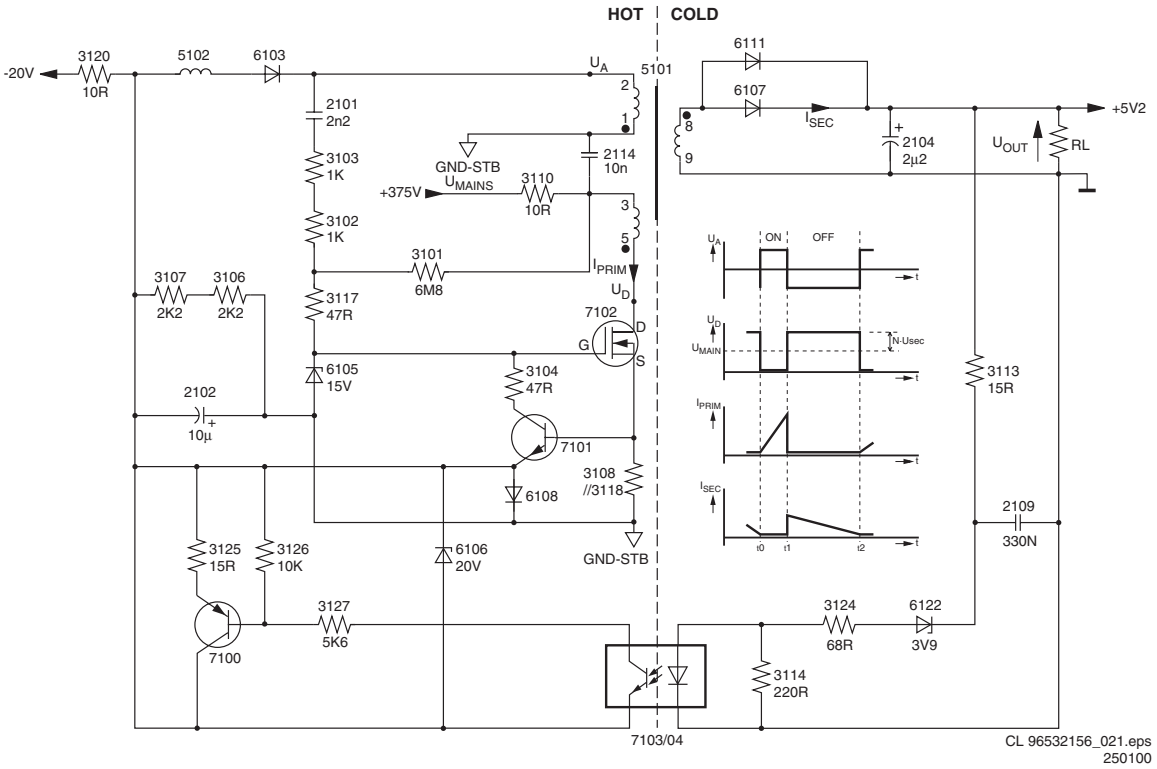


Figure 9-4

To apply this on the EM1A (diagram A2): replace Switch 'S' by FET TS7102, coil L by L5101, diode D by D6107//D6111 and C by C2104.

Time interval t0 - t1:
After switching on the set, the gate of MOSFET TS7102 will be high (max. 15 V due to zenerdiode D6105). This will drive the FET into saturation (UDS = 0 V). The DC-voltage UMAINS will be transposed across the primary winding of L5101 (3, 5) resulting in a linear increasing current through this coil.
The voltage across the co-coupled coil (1, 2) is also positive and will keep the FET into conductivity via C2101, R3103, R3105, R3102 and R3117 for some time. The slope of the primary current is determined by the self-induction of the coil and on the magnitude of the supply voltage (+375 V).
The maximum current is determined by the time the FET stays into conductance (t0 - t1). This time is directly determined by the voltage across R3108//R3118. This voltage is a measure of the current and if it exceeds 1.4 V, TS7101 will be driven into conductivity and consequently connect the gate of TS7102 to earth; the FET will block. The current will be: 1.4 V/(10//4.7 ohm) = 0.43 A.
The voltage across the secondary winding (8, 9) will be negative, diodes D6111 and D6107 will block.

Time interval t1 - t2:
The sudden current interruption in the primary coil, will induce a counter-e.m.f. that wants to maintain the current. The voltage on the drain of the FET will increase. The secondary voltage (8, 9) will become positive and will charge C2104 via D6107 and D6111. All energy that was stored in L5101 during t0 - t1 will be transferred into the load. Due to the transformer principle, a voltage will now be induced in the primary winding (3, 5) and the co-coupled winding (1, 2). This voltage will be: N * USEC (N = winding ratio).
The voltage across the co-coupled coil will be negative, keeping the FET blocked.

Time t2:
At t2, the current through the secondary coil will be reduced to zero, as C2104 is no longer charged. As a consequence, the voltages will decay and will change polarity. The gate of the FET will be again made positive, is driven into conductivity and the cycle starts again.

Feedback, stabilisation:
The Standby Power Supply always oscillates at maximum power; the only limiting factor is the maximum primary current that has been pre-set with R3108//3118.
UOUT is determined by R3114, R3124 and zenerdiode D6122. If the voltage across R3114 exceeds the threshold voltage of the diode of the optocoupler 7104 (±1 V) or, in other words, UOUT exceeds 5.2 V the transistor of the optocoupler will conduct.
Transistor TS7100 will be driven and a negative voltage will be transposed to the emitter of TS7101. When TS7101 conducts, the gate of the FET is at earth potential forcing the oscillator stop. Due to the load, the secondary voltage UOUT will decrease. At a certain voltage, optocoupler TS7103/04 will block and the oscillator will start again.

Since there are no capacitors and there is a high amplification-factor in the feedback circuit, the feedback is ultra-fast. This is why the ripple on UOUT is minimal. The negative supply voltage (-20 V) used in the feedback circuit originates from the co-coupling coil and is rectified through D6103.
Stabilisation is not effected through duty-cycle control but through burst-mode of TS7100.
Burst-mode is load dependent. If the power supply is less loaded, the secondary voltage will have the tendency to increase more rapidly. If the load on the power supply increases, then the oscillator stops less often, right up to the moment that the oscillator is operating continuously: maximum load. If the power supply is now loaded even more, the output voltage will decay. The maximum load is determined by the maximum primary current set by R3108// 3118.

Protection:
If the optocoupler would fail, the secondary voltage will increase. This would have disastrous consequences since many IC's (e.g. Painter, flash-RAM, DRAM) are fed with this 5.2 V. In other words, very expensive repairs would be required.
We already know that the negative supply is directly dependent upon the secondary 5.2 V, as a consequence of which the negative supply will increase proportionally as the secondary voltage increases.
If the negative supply in the mean time reaches -30 V, D6106 will start to zener and as a consequence TS7101 will start conducting. Basically, D6106 will take over the stabilisation task of the optocoupler, however, with a considerable spread: from -20 V to -30 V is a 50 % increase, thus UOUT will increase from 5.2 V to max. 7.5 V.

Main supply (diagram A1)

Some important notes on beforehand:
V_{BAT} **is not isolated from the mains supply ('hot').**
V_{BAT} **is alignment free.**

The Main Power Supply generates the 141 V (VBAT) and the 28 V for the audio part, and is based on the so-called 'down converter' principle.

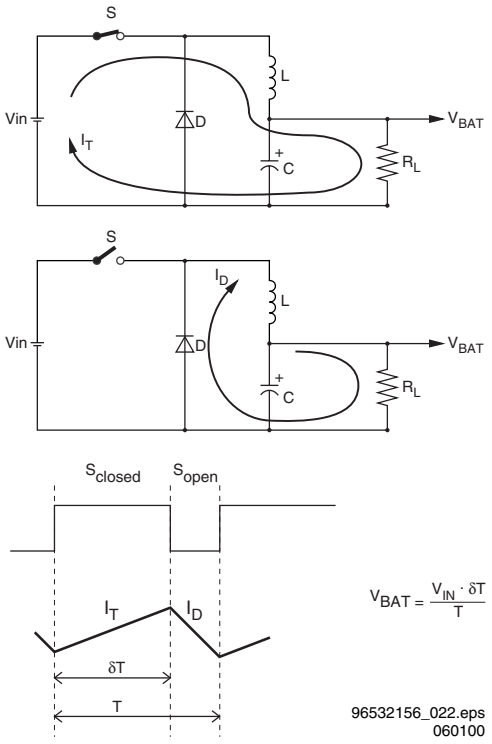


Figure 9-5

- After closing switch 'S', the linear in time increasing current IT, , will charge capacitor C.
- Opening switch 'S' will generate a counter-e.m.f. in coil L, trying to maintain current IT. This is possible via diode D (this diode is also called 'freewheel diode'). So after opening 'S', the magnetic energy stored in coil L will be transferred to electrostatic energy in capacitor C. The VIN will only supply current during the time that 'S' is closed while a constant current is flowing through RL.
- VBAT is directly proportional with VIN and the time that 'S' is closed and reverse proportional with period time 'T'. So by changing the duty cycle, it will be possible to control VBAT.

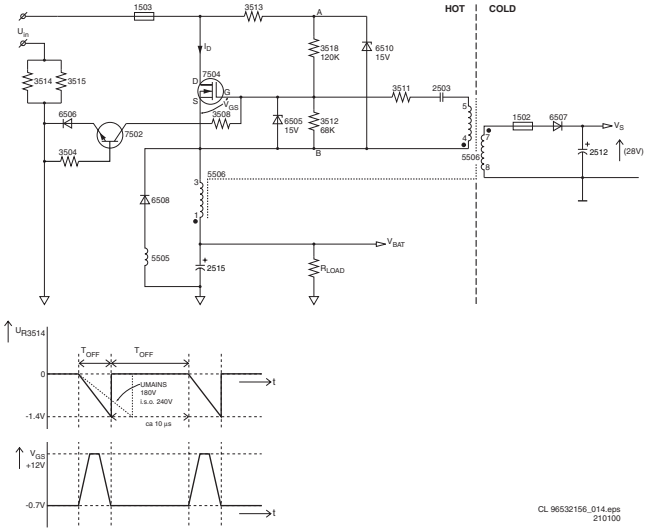


Figure 9-6

At start-up of the main supply, C2515 can be assumed as being a shortcircuit. UAB will be 15 V (R3513, D6510) and UGS of the FET will be +5.4 V (voltage division over R3512 and R3518). The FET will be driven into saturation (same as closing switch 'S'). The drain-current will increase linear in time. With other words: resistors R3513 and R3518 will start the oscillator.
The voltage across the co-coupled coil (4, 5) is also positive and will keep the FET into conductivity.

The drain-current will also flow through R3514//R3515. The voltage on the base of TS7502 will be +0.8 V due to the stabilisation circuit (which is explained further). At increasing current, the emitter-voltage of TS7502 will get more negative. When this voltage reaches -0.7 V, TS7502 will be driven into conductivity and consequently connect the gate of TS7504 to earth; the FET will block (same as opening switch 'S'). The maximum drain-current is: 0.7 V/(R3514//R3515) = 1.4 A.
The voltage polarities on L5506 will invert, keeping the gate of TS7504 negative via the co-coupled coil (4, 5). The voltage on the secondary winding of L5506 (7, 8) will be positive, generating the +28 V audio supply voltage via D6507 and C2512.

The sudden current interruption in the primary coil, will induce a counter-e.m.f. that wants to maintain the current via the 'freewheel' diode D6508. This current is linear decreasing in time and as it is also flowing through R3414//R3415, TS7502 will be blocked after a certain time period. The gate of the FET will be again made positive, is driven into conductivity and the cycle starts again.

Stabilisation of VBAT:
The output voltage VBAT will be determined by: VBAT = VIN * TON/(TON + TOFF) = VIN * duty-cycle.

To stabilise the output voltage, a feedback loop is implemented, which will reduce TON when VBAT increases and vice versa.

Via a voltage divider, excisting of (1 %) resistors R3507, R3510 and R3527, a voltage of 2.5 V (when VBAT = 141 V) is fed to the input of precision shunt regulator 7506. This regulator will conduct, a current will flow through R3524 and TS7505 will be driven into conductivity. The base of TS7502 will now be set at a certain positive voltage. As this transistor switches the FET TS7504 on and off, this circuit can determine the dutycycle.

E.g. when the load increases, VBAT will decrease. As a consequence, the input-voltage of regulator 7506 will decrease, resulting in a lower current. Through that, the emitter-base voltage of TS7505 will diminish.
The current through R3504 will decline, changing the base-voltage of TS7502 and through that the TON (will increase) of the FET. The output voltage VBAT will rise.
If the load continues to increase, the regulator will block at a certain moment, the collector-current of TS7505 will now be zero. If there flows no current through R3504, TON will now be maximum (IMAX = 1.4 A). This is the point where VBAT will be below 141 V, and at further increasing load will be switched off (The voltage across the co-coupled coil (4, 5) will decrease due to the increasing load. Therefore the voltage on the gate of TS7504 comes below the threshold voltage. The supply switches off and an audible hiccuping can be heard).

On the other hand when the load decreases, VBAT will rise. As a consequence, the input-voltage of 7506 will also rise resulting in a higher current. The current through R3504 will rise, changing the base-voltage of TS7502 and through that the TON (will decrease) of the FET. The output voltage VBAT will be reduced.

If, for instance, VIN will decrease (e.g. UMAINS is 180 V i.s.o. 240 V), the slope of the drain-current will be flattened, through which the FET will be longer into conductance, keeping VOUT constant.

If, for any reason, the stabilisation circuit might fail, the output voltage VBAT can never exceed 200 V (via D6514). D6514 will form a shortcircuit, VBAT will drop and the set will switch off (this will result in an audible hick-uping of the supply).

Set to 'STANDBY" (via RC):
When the set is switched to 'STANDBY' via the Remote Control, the Main supply will be switched off.
This is done by the circuit around TS7529 (see diagram A1): During 'ON'-state the Main supply is fed with line pulses via the STANDBY line. They are rectified and smoothed via D6517, D6516 and C2530 and fed to TS7529. Because they are less than -20 V, this transistor will be blocked.
When these pulses are stopped (STANDBY), TS7529 will be saturated and TS7502 will be switched off. This will switch off the Main supply.

Set to 'ON' (via 'STANDBY'):
At the moment the set is switched 'ON', the HOP is not working (as much as possible IC's are made voltageless during 'STANDBY'). Therefore it is impossible that the STANDBY line carries line-pulses, so the main supply cannot start up. This problem is solved via the 'low power start-up' possibility of the HOP.
Via pin 22, the HOP receives, via the STANDBY_INFO line from the Painter, a voltage of 5.2 V coming from the Standby supply. The result will be that the HOP will generate pulses with a nominal TOFF and TON growing from 0 to 30 % of the nominal value.
This signal is unchanged until the Main supply is switched 'ON' and the HOP the correct I^2C-command POR-bit) has received.

Guarding circuit:
The negative pulses on the secondary winding of L5506 are rectified by D6520 and smoothed by C2535. The resulting negative DC-voltage will keep TS7510 blocked, even as TS7511.

When something happens in the Main supply through which these pulses will decrease, the DC-voltage will increase. TS7510 starts to conduct, even as TS7511. Via R3541 and D6522 this situation will be maintained (thyristor principle). The collector of TS7511 drives via R3538 a positive pulse back to the Painter (named STANDBY(POR)). The Painter will now switch off the Main supply via the STANDBY_INFO signal.

SSB
There are 3 voltages used for the SSB: +8 V, +5.2 V and +5 V.
+5.2 V is the Standby voltage; it should always be present.
The 8 V is derived from the 11D V with stabiliser 7906 (on LSP). This 11D voltage is only present when the line-drive pulses start the deflection.
The 8 V is used to switch the +5.2 V with transistor 7905 to supply the +5 V.

9.1.4 Control & Teletext (diagram B7)

Painter
The SAA5667 (IC7001) is called the Painter (OSD, TXT and Control). In this IC, the microprocessor and the TXT-decoder (level 2.5) are integrated.
Some of its functions are:
- Set control.
- TXT/OSD acquisition.
- RGB-outputs to the HOP
- Menu blending; for blending the contrast is software controlled.
- I/O-ports for I2C, RC5, LED, and service modes.
- Error code generation.

The software for EM1A can be 192 kB.
For TXT-data 100 pages can be stored in IC7011.
The Non Volatile Memory IC7011 is a 4-kb version M24C32.

All ICs in this part are supplied with 3V3. For this voltage a 3V3 stabiliser is used (IC7005).
When the 3.3 V is available, a POR is generated with TS7003/7004 to wake up the Painter. During the reset all I/O pins are high. When a POR is generated the TV-set is in Standby mode.

The horizontal (HD100) and vertical (VSYNC) sync pulses are also fed to the Painter for stable OSD and TXT.

Teletext
The TXT-decoder in the Painter gets its video signal directly on pin 31 (from the HIP).
The RGB-outputs are available on pins 46/47/48. Fast blanking is realised via pen 52.
A separate memory is used to store the TXT information (IC7011).

I^2C
In the EM1A-chassis with Painter-processor there are two I^2C-busses used:
- Slow (max. 100 kHz) hardware I^2C-bus (called I^2C1), used for all IC communication.
- Separate short bus (called I^2C3) for the Non Volatile Memory (NVM) to avoid data corruption.

NVM
The Non Volatile Memory contains all set related data that must be kept permanently, such as:
- Software identification.
- Operational hours.
- Error-codes.
- Option codes.
- All factory alignments.
- Last Status items for the customer + a complete factory recall.
- TXT featuring (keeping habit watch data).

9.1.5 Tuner & IF (diagram A7 & B2)

The tuner is I2C-controlled and is capable of receiving off-air, S- (cable) and Hyperband channels:
The tuning is done via I2C. The reference voltage on pin 9 is 33 V. This voltage is derived from the 180 V (from the LOT) via 2 resistors of 120 kΩ (diagram F) and a zenerdiode. The Painter together with the HIP controls the tuning procedure. There is also automatic switching for the different video systems.

The IF-filter is integrated in a SAW (Surface Acoustic Wave) filter. The type of this filter is depending of the standard(s) that has to be received. Two SAW filters are used: One for filtering picture-IF and one for filtering sound-IF.

The output of the tuner is controlled via an IF-amplifier with AGC-control. This is a voltage feedback from pin 62 of the HIP to pin 1 of the tuner. AGC take-over point is adjusted via the service alignment mode 'Tuner AGC'. If there is too much noise in the picture, then it could be that the AGC setting is wrong. The AGC-setting could also be mis-aligned if the picture deforms with perfect signal. The IF-amplifier amplifies too much.

The video IF-signal is fed to pins 2 & 3 of the PLL-controlled IF-demodulator. The voltage controlled oscillator of the PLL is adjusted via the service menu 'IF AFC'. If the alignment is correct then the displayed frequency in the installation menu is the same as the applied frequency from a generator. The external coil L5408 connected between pins 7 & 8 is used as reference. The demodulated IF-video signal is available at pin 10 of the HIP. In this video signal there is a rest of sound carrier, which is filtered by the sound trap 1406 or 1407 (depends on the received standard).
Then the signal is fed to the HIP again (pin 12) where the group delay can be corrected, dependent on the standard that is received. On pin 13 the CVBS-signal becomes available which is used for further processing in the TV. Via TS7322 the signal is supplied to AV1 (PIP/DW) and back into the HIP (pin 14) to the I/O selection.

To realise quasi split sound, the IF-signal is fed to the HIP on pin 63 & 64 via SAW-filter 1405. The FM (or AM for L-norm) -modulated signal is available on pin 5 and is fed to the audio demodulator MSP34xx.

9.1.6 Video: High-end Input Processor (HIP, diagram B2)

In the EM1A the TDA932xH input processor is used, which contains the following functions:
- IF demodulation.
- Group delay correction.
- AFC signal generation, used to track drifting transmitters.
- Sound carrier re-generation (SIF).
- AM demodulation.
- Sync acquisition, delivering HA and VA.
- Switching off IF-filtering.

The HIP has various inputs.
- Full matrix switch with:
  - 2 CVBS inputs
  - 2 Y/C (or additional CVBS) inputs
  - 1 CVBS front end input
- Two RGB and 1 YUV-input

Outputs: Three separate switchable outputs can be used:
- 1 YUV-output is fed to the PICNIC
- 2 CVBS outputs: One for Teletext Dual Screen and the other for output to MONITOR OUT to have WYSIWYR (What you see is what you record)

The input signals from the Front I/O are fed to the HIP and front detection is fed to the Painter.
AV1 is a CVBS- and a YUV input (e.g. for DVD), while AV2 is meant for CVBS and Y/C (SVHS). The 3rd option is a MONITOR OUT-output.

Video processing
The sandcastle-pulse of the HIP will not be used for synchronisation. The HOP will generate synchronisation signal derived from the feature box (PICNIC) signals. The HIP itself (no external voltage) controls the Y/C switch in the HIP.
The chrominance decoder in the HIP is full multistandard: PAL/SECAM/NTSC.
Two different crystals can be connected to the pins 54 & 57 without any alignment. The crystals are also used as a reference for the synchronisation. A digital control circuit that is locked to the reference signal of the colour decoder determines the start-up of the sync. This crystal may only be replaced by the original one. If just a crystal is taken, the internal capacitance will be different and the effect will be that there is no colour.
In the HIP, a sync separation circuit has been integrated; the HIP delivers the HA and VA (50/60 Hz) to the PICNIC and PIP/DW module. On pin 59 there is the 1fH sandcastle but this is not connected to any circuit and only used internally for the colour demodulator. The 2fH-sandcastle signal is generated by the HOP.

9.1.7 Video: Feature box (PICNIC, diagram B3)

Introduction
The basic function of the Feature box (FBX6) is picture improvement, and depending on the version several scan conversion methods can be applied. The PICNIC is the central key component.
In the EM1A-chassis the featurebox is integrated on the SSB. The PICNIC is used for the 100 Hz conversion. In the PICNIC the following functions are present:
- The ADC.
- The DAC.
- The 100 Hz conversion.
- The noise limiter (DNR).
- The contrast improvement.

All these functions are integrated in one IC: SAA4978H, a 160 pins QFP

ADC/DAC
Analogue to Digital conversion is done with three identical 9-bit ADC's.
Digital to Analogue conversion uses three identical 10-bit DAC's.
In the PICNIC there are three 9 bits ADCs present for Y, U & V. For digitising the Y (luminance) 9 bits are used, to realise a more detailed picture. The 9 bits are only internally used. Via dithering the 9 bits are reduced to 8 bits and that data is stored into the memory. The data in the memory is fed back to the PICNIC and via undithering the data is again reproduced 9 bits for processing.
U/V (colour difference signals) is also sampled with 9 bits. These two 9 bit data streams are multiplexed to 4 bits data streams. This reduction can be allowed, as the perception for colours by the human eye is less sensitive as for luminance.

100 Hz conversion
The main task of the PICNIC is the conversion from 50 Hz to 100 Hz for YUV and HV-sync. In order to remove 'large area flicker' (especially visible in a white picture), the field-rate of the video is doubled by the FBX6. A 50 Hz frame frequency is converted to 100 Hz. Also the line frequency (16 kHz) is doubled (32 kHz). Basically, when the video input contains fields A, B etc..., the conversion provides an AABB sequence on the display. The actual conversion is done in the first Field Memory by reading it twice at double speed, while writing it once.

Automatic Aspect Ratio Adaptation (AARA)
This feature uses data from the 'black bar detection circuit' to adapt the vertical and horizontal amplitude to an aspect ratio belonging to the display without showing the black bars.

CTI
At CVBS video signals, the bandwidth of colour signals is limited to 1/4 of the luminance bandwidth. Transients between areas of different colours are therefore not very sharp. The PICNIC can steepen these transients artificially with a time manipulation algorithm.

Dynamic Contrast
To make the contrast (black/white) range wider, Philips has invented Dynamic Contrast. It uses the digital memory used in 100 Hz sets. It measures every A-field (25 x/s) and digitally analyses where on the greyscale most of the image is located. If it's a relatively dark image, the lighter part of that image is stretched towards white, so that more contrast will become visible in that picture. If it's a relatively light image, the darker part of that image is stretched towards black, so that these darker parts will have more contrast. When the image is in the middle of the greyscale, both dark and light parts are stretched.

PROZONIC

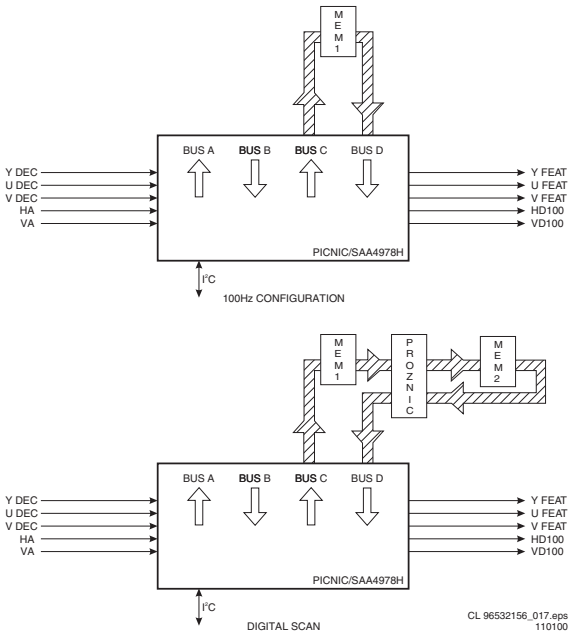


Figure 9-7

To the PICNIC external IC's are connected dependent of the features.
If EM1A has only 100 Hz, then only one memory-IC is used to store one frame.
For sets with Digital Scan the PROZONIC (IC7708, SAA4990H) is added with two memory-ICs (IC7714 & 7715). It is an abbreviation for PROgressive scan Zoom and Noise reduction IC.
When applying this, the 2nd Field Memory has to be installed. The following functions are available:
- Line flicker reduction (Digital Scan): this is a feature to reduce the 25 Hz interlace line flicker.
- Dynamic Noise Reduction: noise affected signals can be improved by combining the pixel values of the current and past video fields. This is however only possible in areas without movement.
- Variable Vertical Sample Rate Conversion
- Synchronous No Parity Eight bit Reception an Transmission interface (SNERT-bus)

Depending on the chassis model, the FBX6 can have the following specification:

Featurebox 6 diversity	
Set	Chipset
EM1A 1fH	N.A.
EM1A 2fH	1 Memory
EM1A 2fH DNR	1 Memory incl. DNR
EM1A 2fH Dig. Scan	PROZONIC + 2 Memories

9.1.8 Video: High-end Output Processor (HOP, diagram B4)

General
In the HOP (High-end Output Processor, TDA9330) the video processor and digital deflection processor are integrated. The main functions of the HOP are:
- Video control (contrast, brightness, saturation, etc.).
- 2nd RGB interface for OSD/TXT.
- Peak White Limiting.
- Cut-off control and White Drive (RGB outputs).
- Geometry control.

The YUV-signals from the PICNIC are fed to the HOP. In the HOP, the video and geometry control parts are integrated. Also the RGB-signals from TXT/OSD are inserted via the HOP. This IC has all functions from a video processor and geometry control (like the DDP in MD2). The geometry part delivers the H-drive, EW-drive and also a drive signal for rotation. The internal V-drive circuit of the HOP is not used (is explained further on).

Video Control
After conversion to RGB again, the signals can be controlled for Saturation, Contrast and Brightness.

2nd RGB interface for OSD/TXT
On pins 35 - 38 the RGB and fast blanking from the Painter (OSD and TXT) are inserted.

Peak White Limiting
On pin 43 there is a Peak White Limiting signal line (PWL). If the beam current (EHT-info line) increases, then the EHT-info voltage will decrease. PWL is controlled by average limiting via R3343/C2333.

Cut-off control
Switching the TV to Standby:
1. Vertical scan is completed.
2. Vertical flyback is completed (the horizontal output is gated with the flyback pulse, so that the horizontal output transistor cannot be switched on during the flyback pulse).
3. Slow stop of the horizontal output is started, by gradually reducing the 'on' time at the horizontal output from nominal to zero (this will take 50 ms).
4. At the same time the fixed beam current is forced via the black current loop for 25 ms. This is done by setting the RGB outputs to a maximum voltage of 5.6 V.

In the EM1A a 'one-point' cut-off control is used:
A current of 8 µA (for cut-off) is fed to pin 44 of the HOP. This is done with a measurement pulse during the frame flyback.

During the 1st frame, 3 pulses are generated to adjust the cut-off voltage at a current of 8 μA. With this measurement the black level at the RGB-outputs is adjusted. So at start-up there is no monitor pulse anymore.
At start-up, the HOP measures the pulses, which come back via pin 44. The RGB-outputs have to be between 1.5 V and 3.5 V. If one of the outputs is higher than 3.5 V or one of them lower then 1.5 V, the RGB-outputs will be blanked.

Geometry control
All geometry control is done via I2C and the data is stored in the NVM (IC7012) of the SSB.

Line drive (LINEDRIVE1).
Line drive is derived from an internal VCO. As a reference an external resonator is used (1301). The internal VCO is locked with the HD100-pulse, which comes from the PICNIC. The 'PHI-2' part in the HOP receives the HFB_X-RAY_PROT (pin 13) to correct the phase of the line drive. The EHT-info is supplied to pin 14 (DYN-PHASE-CORR) to compensate picture breathing depending on the beam current.

Frame drive (FRAMEDRIVE+).
The VD100 signal from the PICNIC will be extended for 16.5 lines by the circuit around TS7309 and 7311. The resulting signal (VDHOP) will drive TS7310. This will result in the (asymmetric) FRAMEDRIVE+ signal.
Note: The Frame outputs (pins 1/2) of the HOP are not used!

East/West drive.
At pin 3 the E/W-drive is available. Pin 4 is a feedback input for the EHT-info and is used to prevent pumping of the picture. EHT varies also dependent of the beam current.

Frame rotation.
For frame rotation a control voltage is used from pin 25 of the HOP. This voltage can vary from 0.4 till 4 V.

Guarding protections:
- Flash detection:

When a flash occurs, the EHT-info will become negative very fast. Via D6303/D6304/R3316, TS7303 starts to conduct. This makes pin 5 of HOP high. When pin 5 of HOP is high, then the output (pin 8) is immediately stopped. If the H-drive stops, then also pin 5 will be low again, which will reset the flash detection. A bit (FLS) will be set in an output status register, so via the Painter it can be seen when there was a flash. This FLS-bit will be reset when the Painter has read that register.
- HFB protection:

If the HFB is not present then this will be detected via the HOP. The Painter puts the TV into protection and an error code will be generated.

9.1.9 Synchronisation (diagram B3 & B4)

The HIP video processor provides vertical and horizontal sync pulses V_A and H_A, which are synchronised with the incoming CVBS signal. These pulses are fed to the PICNIC where they are doubled to be synchronous with the 100 Hz picture. The outgoing pulses, V_{D100} and H_{D100} are fed to the HOP that supplies the vertical and horizontal drive pulses and the $2f_H$ sandcastle pulse.

The VD100 pulse from the PICNIC is only one line long. Therefore this pulse is converted into a VDHOP signal by a 530 μs monostable oscillator (extended by 16.5 lines). This signal is on block function level equal to VSYNC and FRAMEDRIVE+.

The Painter is synchronised on the HD100 pulse from the FBX and on the VSYNC for the synchronisation of TXT/OSD.

When no CVBS is offered to the video processor, the VA and HA pulses are switched off by the HIP, and the VD and HD pulses are then generated by the PICNIC. This to assure a stable OSD.

9.1.10 Horizontal (line) deflection (diagram A3)

Driving the line output stage

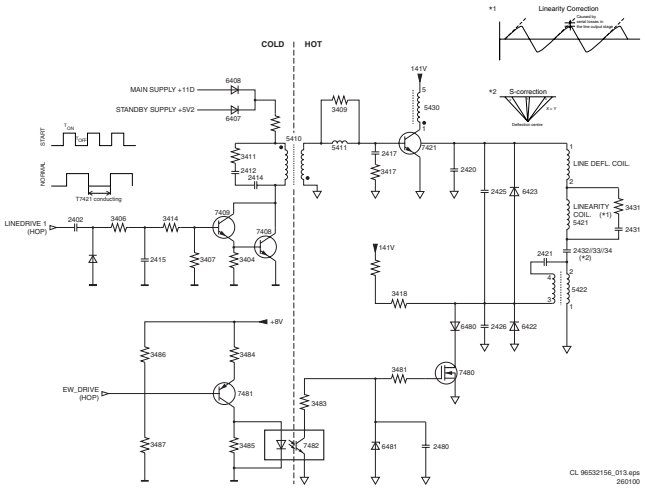


Figure 9-8

The HOP (located on the SSB) generates the line-drive pulses (LINEDRIVE1), which have a frequency of 31250 Hz (T = 32 μs).

When the LINEDRIVE1 signal is high, TS7409 and TS7408 will conduct. A constant DC voltage will be applied across L5410, causing a linear increasing current through this coil. The secondary voltage of L5410 has a negative polarity so that TS7421 will block. When switching on the set, the current through L5410 is supplied by the 5V2 Standby supply (via D6407), and taken over by the +11D voltage (via D6408) of the main supply.

When the LINEDRIVE1 signal becomes low, TS7409 and TS7408 will block. The voltage polarity across the primary winding of L5410 will invert. The positive voltage on the secondary winding will now drive TS7421 into conductivity. Because of the storage time of the line transistor (TS7421), L5410 cannot transfer its energy immediately to the secondary side. This may result in high voltage peaks on the collector of TS7409 and TS7408. To prevent that these peaks will damage the transistors, a 'snubber' circuit (C2414, C2412 and R3411) will suppress them.

When the LINEDRIVE1 signal is high again, the above-described sequence starts again. Circuit L5411 and R3409 will increase the switch-off time of the line transistor.

The line stage will be started via the 'slow start' principle. During start-up, the HOP generates line drive pulses with a small TON and a high frequency (50 kHz); TOFF will be constant and TON will be gradually increased until the duty-cycle is 50 % (normal condition). The time interval from start to normal condition takes about 150 ms. When switching off, the same procedure is followed, but now in reverse order.

Operation of the line output stage
To explain the operation of the line output stage, we use the following start conditions:
- C2433 is charged to max. 141 V (VBAT)
- TS7421 is driven into conductivity.

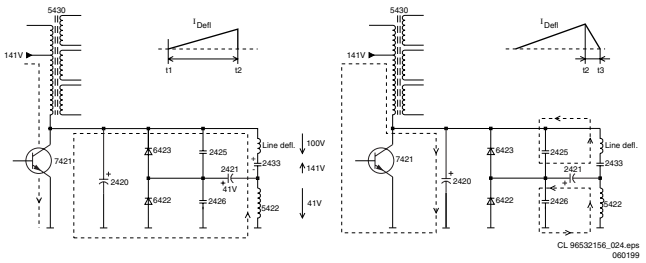


Figure 9-9

Period t1 - t2:
When TS7421 is driven into conductivity, the capacitor voltage of 141 V, will be divided across bridgecoil L5422 and the deflection coil (conn. 0317). Due to the chosen inductance values, there will be 100 V across the deflection coil and 41 V across L5422. The linear increasing current in the deflection coil will result in a spot moving from the centre of the picture tube to the right.
The voltage across L5422 will also charge C2421 (41 V - 0.7 V).

Period t2 - t3:
At the moment the LINEDRIVE signal becomes high, TS7421 will stop conducting. In the coils a voltage will be induced, trying to maintain the current. The current through the line deflection coils continues to flow through C2425 and C2421 and the current through L5422 continues to flow through C2426 and C2421. The energy stored in the line deflection coil is passed to C2425, and the energy of L5422 to C2426.
The resonance-frequencies of these 2 LC-circuits define the flyback time of the spot from the right side of the picture tube to the left.
On average no current flows through C2421 and thus the voltage across this capacitor remains constant.

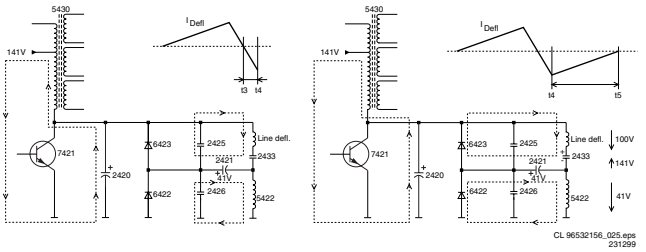


Figure 9-10

Period t3 - t4:
As for the period t2 - t3; but now the current flows in the opposite direction, since the voltage across C2425 and C2426 is higher than the voltage across C2433 and C2421.

Period t4 - t5:
The coils want to maintain the negative current and will charge the capacitors negative. Because of this, D6422 and D6423 will conduct. The voltage is 100 V across the deflection coil and 41 V across L5422. As both diodes conduct, we may consider the voltage to be constant. A linear current flows with the same changing characteristics as in period t1 - t2. The spot now moves from the extreme left of the picture tube to the centre. Before the current becomes zero, and the spot is located in the centre of the frame, TS7421 reverts back into conductivity. First a short negative current will flow. The cycle starts again.

The linearity correction
A constant voltage across the horizontal deflection coil should result in a linear increasing saw-tooth current. This however is not the case as the resistance of the coil is not negligible. In order to compensate for this, a pre-magnetised coil L5421 in series with the deflection coil is used. This coil ensures that during time interval t1 - t3 the circuit-resistance will be higher than during t4 - t5. L5421 is called the linearity coil.
To avoid self-oscillation, R3431 and C2431 are placed parallel to L5421.

The S-correction
Since the sides of the picture are further away from the point of deflection than the centre, a linear saw-tooth current would result in a non-linear image (the centre would be scanned slower than the sides). To solve this, the deflection current for the right- and left side will be reduced.
C2433 is charged quadratic during time interval t1 - t2. Left and right the voltage across the deflection coil decreases, causing the deflection to slow down. In the centre, the voltage increases and the deflection will be faster. An S-shaped current will have to be superimposed onto the saw-tooth current. This correction is called finger-length correction or S-correction. C2433 is relatively small, as a result of which the saw-tooth current will generate a parabolic voltage with negative voltage peaks. The current also results in a parabolic voltage across C2421, resulting in the finger-length correction, proportionally increasing with the picture width. The EW-DRIVE signal will ensure the largest picture width in the centre of the frame. Here the largest correction is applied. The larger the picture width, the higher the deflection current through C2433.

The E/W-correction
A line, written at the upper- or lower side of the screen, will be larger at the screen centre when a fixed deflection current is used. Therefore the amplitude of the deflection current must be increased when the spot approaches the screen centre. This is called East/West correction.
The EW-DRIVE signal is generated in the HOP and will drive FET TS7480 via TS7481 and optocoupler TS7482. TS7480 will charge capacitor C2423 more or less, increasing the deflection current when reaching the centre of the screen.

Secondary line-voltages
During the blocking time of TS7421, the magnetic energy of coil 1 - 5 of the LOT will be transferred to electrical energy in the secondary winding. Via rectifying and smoothing, the several secondary supply voltages will be generated:
- EHT, Focus and Vg2-voltage
- +180V for the CRT panel (pin 8 LOT)
- +11D for the line deflection (pin 12 LOT)
- +13VLOT for the frame deflection (pin 6 LOT)
- -15VLOT for the frame deflection (pin 3 LOT)
- Filament voltage (pin 9 LOT)
-

The EHT-INFO signal is derived via R3450//R3451. This signal decreases while the beam current increases. It is fed to the HOP to compensate for loss of picture width and picture height.

The DYN-FASE-CORR signal is fed to the HOP via C2455 and drives a dynamic phase correction necessary because of beam current variations. This is done by regulating TON of the line transistor TS7421.

East-West circuit
The moment TS7480 is driven into saturation, C2421 will discharge during the flyback. As a consequence of which C2421 must be charged again during the scan via the conduction diode D6422 (as long as C2421 is not charged to the voltage across L5422, D6422 will conduct). The current in the deflection coil is therefore larger than the current

flowing in L5422 (1-2). The voltage across the deflection coil increases, so the picture width increases. When TS7480 blocks, C2421 will not discharge anymore and the voltage across C2421 will remain constant. The result is that the voltage across the deflection coil is minimal. The voltage across coil L5422, however, is maximal. This coil (L5422) consists of a transformer:

- As the current through the coil 1-2 increases (smaller picture width), the current through coil 3-4 decreases. Because of the transformer characteristic a higher voltage will be subjected to coil 3-4, which will counteract the current. The current will diminish even further.
- When the current through coil 1-2 diminishes (larger picture width), the current through coil 3-4 increases.

The EW Drive

The EW drive signal originates in the HOP and is supplied to TS7480. The shape of this signal determines the various geometric correction parameters:

- H amplitude
- EW-parabola
- EW-corner
- EW-trapezium
- Horizontal parallelogram
- Horizontal bow

Beam current correction

The EHT-info at point 10 of the LOT is dependent on the value of the beam current and the voltage divider R3450, R3451 and C2450. The EHT-info is fed to the HOP to trim the contrast and to compensate for the changes in picture-width as a function of the EHT-info, when the high-voltage is decreased. The EHT-info is integrated via C2450 and sent to the gate of the E/W FET (TS7480) as a DC-voltage to correct the EW-current.

9.1.11 Vertical (frame) deflection (diagram A4)

Driving the frame output stage

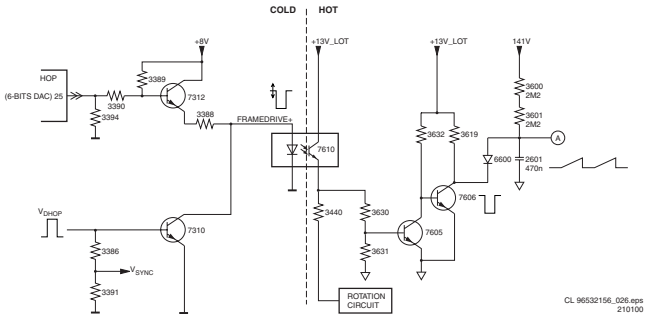


Figure 9-11

The HOP drives the frame output stage. As the HOP is 'cold' and the frame output stage is 'hot', they must be galvanic isolated. This is done by means of an optocoupler. In the MG-chassis the HOP generates 3 signals needed for the frame output stage: VDPOS, VDNEG and FRAME ROTATION. To avoid the costs of 3 optocouplers, the frame drive pulse and rotation DC-voltage are added together and then fed to optocoupler TS7610.This is done as follows:
The VD100 signal from the PICNIC (diagram B3 pin 19) is extended for 16.5 lines and inverted via a monostable multivibrator (TS7311 & TS7309, diagram B4). The output signal VDHOP is then superimposed on a DC-voltage from pin 25 of the HOP. The resulting signal is called FRAMEDRIVE+ and is fed to optocoupler 7610 (diagram A4). So this signal contains info for both the frame deflection and the frame rotation (if present).
The circuit around IC7440 will amplify this signal and the output current will flow through the rotation coil. The vertical pulses on this signal are filtered by C2445 to ensure that only a DC-voltage will be supplied to the rotation coil.

The output voltage of the rotation circuit is between -8 and +8 V.

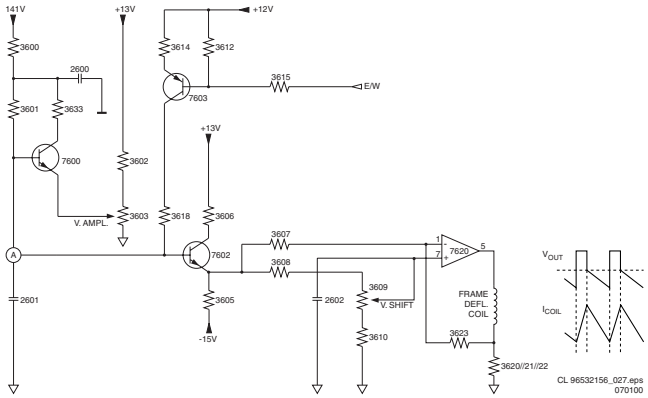


Figure 9-12

The sawtooth voltage for the frame output stage is not generated by the HOP but by a discrete circuit after the optocoupler 7610: via R3600 and R3601 a linear increasing voltage over C2601 is built up with a large time constant. The circuit around TS7603 is a current source, driving C2601 with a current value derived from the E/W modulator. This will result in an S-shaped voltage on C2601 (also known as EW-correction).

Flyback generator

The frame output stage is supplied via the +13 V and -15 V coming from the LOT. The output of the amplifier is 0 VDC, so a coupling capacitor is not required.

During the (forward) scan, a supply of +13 and -15 V is sufficient to respond to the slow changing current. The flyback generator puts a voltage of -15 V on pin 3. Because of the voltage drop over zenerdiode D6622 (8.2 V), C2622 will be charged to 19 V: being 13 + (15 - 8.2 - 0.7) V. During the flyback scan, the change in current per time is much larger, so a higher voltage is required. The flyback generator will now generate a voltage of +13 V on pin 3. Added to the charge on C2622 this will give a flyback voltage of 32 V (depending on the CRT size, this value can differ).

The IC amplifier (IC7620, pin 5) supplies the sawtooth current to the frame deflection coil. The current through this coil is measured via R3620//R3621//R3622 and fed back to the inverting input of the amplifier.
R3624 and C2624 on the output of the amplifier, form a filter for high frequencies and in that way also prevents oscillations.
Peak voltages on the output, e.g. as a result of a possible flash, are damped by the clamp circuit consisting of D6619, C2627 and R3627. The network consisting of R3625, R3629 and C2629 form an extra damping circuit.

Protection circuit for bridge-coil and frame output stage

The secondary voltage of bridge coil L5422 is guarded at the diode modulator (D6421/22) via a detection circuit consisting of an 8.2 V zenerdiode (diagram A3). When the bridge-coil is working properly, the average voltage on D6422 is such that this zenerdiode will conduct and will drive TS7652 into saturation via the BRIDGE_PROT signal (see diagram A4). When, for any reason, the secondary side of the bridge-coil is shorted, the average voltage on D6422 will drop below the zener-voltage and TS7652 will block. Now capacitor C2642 will be charged. Transistor TS7407 will start conducting and the STANDBY signal will be grounded via R3403. This will switch off the main supply (see diagram A1).

Via the circuit built around TS7641 the frame output stage is guarded. If the frame output stage is working properly, TS7641 and TS7652 will both conduct and thereby discharging C2642. TS7407 is blocked now, causing the STANDBY signal to be high ohmic.
If there are frame pulses missing, TS7641 will block and capacitor C2642 can be charged. Transistor TS7407 will now start conducting and the STANDBY signal will be grounded via R3403. This will switch off the main supply (see diagram A1).

9.1.12 Audio (diagram B6, A5 & A6)

Introduction
All EM1A sets contain one of ITT's Multistandard Sound Processing IC's for sound decoding. The diversity arises because each member of the MSP-family handles its own set of sound standards:

- MSP3415D: Europe & AP decoding, Stereo incl. NICAM.
- MSP3451G: Global decoding, Virtual Dolby.

This IC takes care of the main FM sound decoding. AM decoding for the L system is done by the HIP. The demodulated L sound is then again source selected and processed in the MSP. The reason for this is the bad AM detection performance of the MSP. In case of NICAM L however, this is handled by the MSP.

All MSP versions contain digital audio processing, used for the basic left/right stereo sound, such as bass, treble, balance, incredible sound and spatial. In addition to that, the MSP3451 is also able to perform Virtual Dolby, a Dolby approved sound mode for surround sound reproduction with left/right speakers only.

Audio source selection
MSP3515D (stereo)
This IC is an economised version of the MSP3410 that is used in the MG-chassis. It can cover 2 stereo and 1 mono (AM) input. Since more inputs are required, a separate source selector is used (HEF4052, IC7675). This selector has AV1, AV2, FRONT and MON-OUT (Tuner) as input and is connected to the EXT1 input of the MSP3415. The EXT2 input is not used.

Since the MSP3415 has only one EXT output, which is connected to the EXT1, a constant level output and connection to EXT2 is not available. This is fixed by connecting the HEF4052 input selector to the constant level output and to EXT2 via a so-called 'Régimbeau' switch (IC7652).
This switch is needed to prevent feedback (Larsen effect). When EXT2 is chosen as input signal, and the output of EXT2 is selected, this means that the main picture is also EXT2 and will cause the Larsen effect. To prevent this, the record select must be switched to Tuner. This is especially important when decoders are used, behind a 'transparent' VCR connected to EXT2.

To get a constant level output if the Tuner is selected, the EXT1 output (Tuner at any time), has to be fed back to the input selector and selected as input for the MSP (EXT1 input).

The MSP3415 has no separate output to drive a headphone. The headphone is therefore hardwired (on the LSP) to the main sound output.

MSP3451G (Virtual Dolby)
The MSP3451, which is used in all versions supporting Virtual Dolby, is capable of supporting 4 stereo inputs and 1 mono (AM) INPUT. Therefore the extra input selector (HEF4052) is not needed.

The MSP3451 is also capable of supporting 2 EXT outputs, so the trick used in the MSP3415 set-up to get a constant level output is not needed.

The MSP3451 has a separate headphone output, so sound control be done separate from the speakers.

Audio decoding
At the input a choice can be made between two IF-signals; SIF and SIFM.
The selected signal is fed to the AGC. After this, an ADC converts the IF-signal to digital.

This digital signal can be processed by 2 demodulation channels. The first one is able to handle FM and NICAM signals. The second one can handle FM and AM signals.

Each channel contains a mixer to shift the incoming signal in the frequency domain. This shift is determined by the value of a DCO (Digital Controlled Oscillator)..

After the down-mix, the signal is fed, via a filter, to a discriminator. From here the AM, FM or NICAM demodulation can be performed.

Both channels contain an 'automatic carrier mute' function, which automatically mutes the output of the analogue section when no carrier is detected.

After demodulation, the FM-signals are subjected to a de-emphasis operation. After that the matrix of the stereo system is applied.

Audio processing
The sound processing in EM1A is completely done by the MSP3415D for 'Stereo' sets and the MSP3451G for 'Virtual Dolby' sets:

- Volume control is done by the user via the SOUND menu.
- Tone control is done via the BASS/TREBLE control.
- Headphone control in 'Stereo'-sets is done via the loudspeaker output of the MSP, no sound control possible. In 'Virtual Dolby'-sets, the MSP has a separate Headphone output so separate sound control is possible.
- Mute control can be done in different ways:
  - Via the SOUND_ENABLE line of the Painter. Used during start-up/switch-off conditions, in order to avoid audible plops. This line is active low (high = mute).
  - Via the decoding part of the MSP.
  - Via the processing part of the MSP.

The mute on the RC or in the UI is per today a combination of processing mute and SOUND_ENABLE line. When a user mute is done, the processing mute will turn down the volume, after which the SOUND_ENABLE line is switched. De-muting is the other way around. The reason for this is a technical problem with crosstalk of the headphone into the loudspeakers.

Automatic Volume Levelling (AVL)
One of the features of the MSP-family is AVL. If used, it limits the big volume differences in the broadcast between e.g. news transmissions and commercials or within a movie.
To be able to get a Dolby approval (for the Virtual Dolby sets), the AVL feature must be switchable. Therefore, the AVL feature is customer switchable via the menu.

Audio amplification
The audio amplifier part is very straightforward. It uses 2 integrated power amplifier ICs (TDA2616). It delivers an output of 2 x 10 WRMS to 2 full range speakers and/or subwoofer.

The supply voltage is +28 V, generated by the main supply via L5506.

Muting is done via the SOUND-ENABLE line connected to pin 2 of the amplifier-IC and coming from the Painter. This signal is inverted by TS7730, as a result of which at a high level of the SOUND-ENABLE signal, current is sinked from pin 2 and the IC mutes.

9.1.13 CRT & SCAVEM (diagram F)

RGB amplifiers

On the CRT panel, the RGB amplifier (TDA6108, IC7307) is located. Via the outputs 9, 8 and 7 the cathodes of the picture tube are driven.
The supply voltage for the amplifier is 180 V and is derived from the LOT.

SCAVEM

The SCAVEM-circuitry is implemented in the layout of the picture tube panel. It is thus not an extra module. SCAVEM means SCAn VElocity Modulation. This means that the picture content influences the horizontal deflection. In an ideal square wave, the sides are limited in slope by a limited bandwidth (5 MHz).
SCAVEM will improve the slope as follows: At a positive slope, an SCAVEM-current is generated which supports the deflection current. The first half of the slope the spot is accelerated and the picture is darker, while at the second half of the slope, the spot is delayed and the slope becomes steeper.
At the end of the slope, the SCAVEM-current decays to zero and the spot is at the original position. An overshoot occurs which improves the impression of sharpness. At the negative slope, the SCAVEM-current counteracts the deflection.
During the first half of the slope, the spot is delayed and the slope becomes steeper.
During the second half the spot accelerates, the SCAVEM-current is zero at the end of the slope.

Via the three resistors R33315, R33317 and R3320, Red, Green and Blue are added together and offered to the emitter TS7300. On the collector of this transistor, configured in a common base, the sum of these 3 signals is obtained. Via the emitter follower formed with TS7301, this signal is conveyed to the differentiator C2303, R3309 and R3318. Only the high frequencies are differentiated (small RC-time).
The positive and negative pulses of this signal drive respectively TS7303 and TS7302 into conductivity. The DC setting of the output stage is set by R3304, R3308, R3316 and R3319. The working voltage of the transistors is settled at half the supply voltage.
At the positive section of the pulse, the current flows through R3318, C2307, the SCAVEM-coil and TS7303. At the negative section of the pulse, the current flows through R3318, C2409, the SCAVEM-coil and TS7302.

9.1.14 Double Window (DW)

Introduction

The Double Window (DW) panel provides the option for viewer to see two pictures or programs on the displayed area of a TV screen. The displayed pictures can be in PIP mode or DW mode. The viewer can also select the size and position of the 'second' picture.

The DW-models always have 2 tuners. In the AP execution, the TV uses one RF signal, which is connected, to the tuner with splitter located on the DW panel. The 2nd tuner on the main panel is fed with the signal from this splitter. Due to this connection, the Main PCB tuner (Tuner 1) always processes the Main Picture, and the tuner located on the DW panel (Tuner 2) always process the DW picture. If the picture between the two tuners need to be swapped, then the tuner RF frequency is swapped.
The AV-switching is the same for all regions.

Key components

- Tuner (7201):
  - AP Non-China TEDE9X700A
  - China TEDE9X701A
- SAW Filter (1352):
  - AP Non-China OFWK7260M (39.8MHz)
  - China OFWK6287K (38.0 MHz)
- IF + Video processor (7301):
  - AP/China & LATAM TDA8889H
- PIP processor (7801) SAB9081H
- Switching IC's TDA8601 (7803), HEF4053 (7401 & 7402)
- IO expander (7403) M62320P

Block Diagram

There is one configuration as shown below.

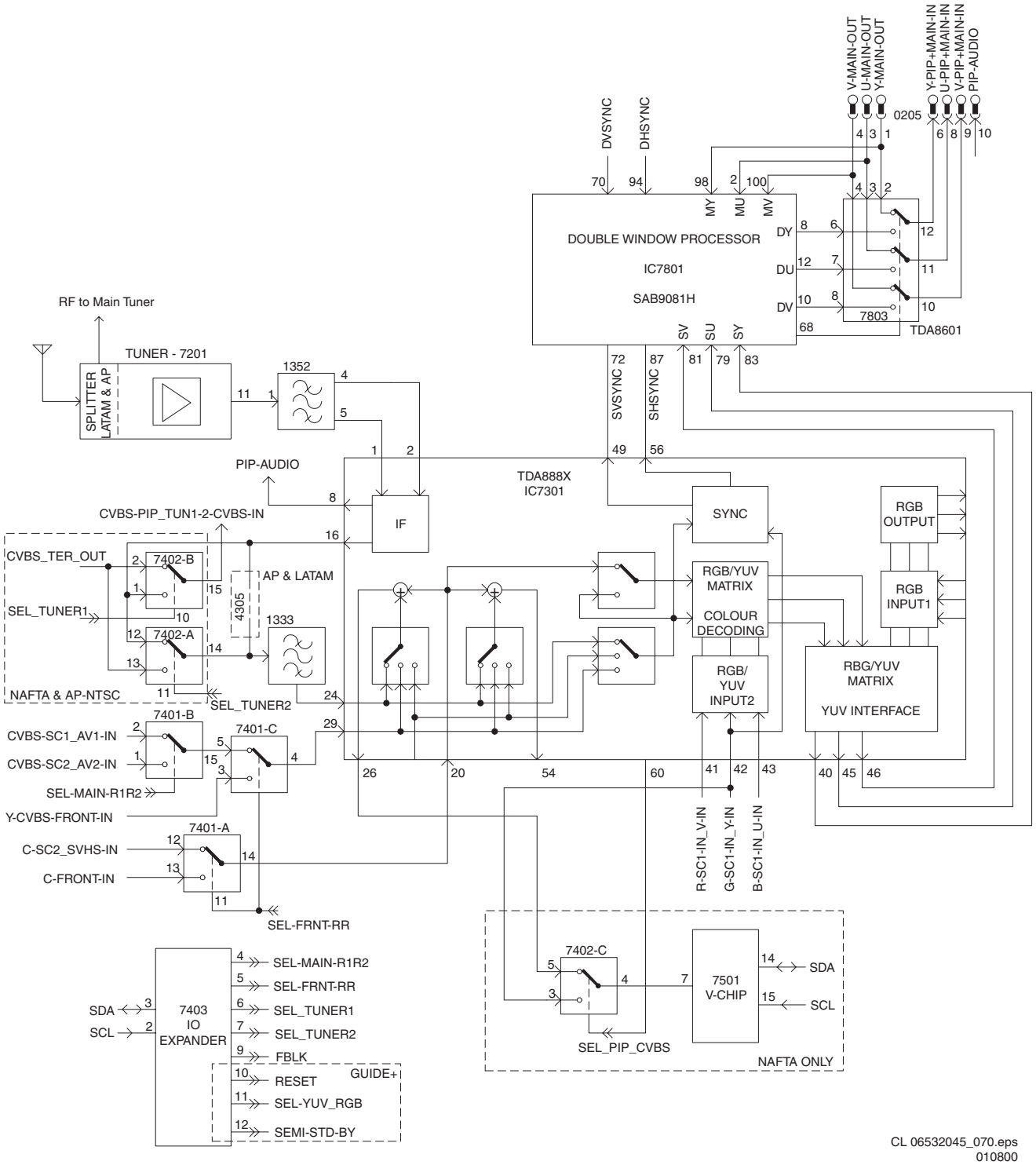


Figure 9-13

Circuit Description

IF & Video section

The TV uses one RF input to the DW's tuner with a splitter. The tuner on the main board receives RF from the splitter. Due to this configuration, the main board tuner always processes the Main picture while the DW tuner always processes the Sub picture. If the picture between the two tuners needs to be swapped, then the tuners' RF frequencies are swapped.

IF-TER from the tuner is fed to pin-1 & 2, IF circuits of TDA888x IC7301 via a SAW filter. The AGC voltage for the tuner can be adjusted in the SAM's tuner menu.

Dependant of the region execution, different SAW-filters are applied.Therefore circuit diversity is unavoidable as shown in figure below. The RESET-signal is used to set the SAW-filter to different IF frequency modes. Table below shows IF frequency settings by the RESET signal.

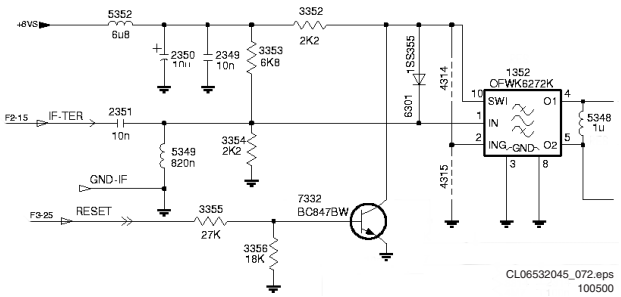


Figure 9-14

SAW-filter (pos. 1352)	RESET = Low	RESET = High
AP P/M (38.9MHz)	NTSC-M/N	PAL BG/DK/I
China (38.0MHz)	NTSC-M/N	PAL BG/DK/I

In order to display the external AV sources by the DW panel, source selection circuit is incorporated on the panel. In EM1A, 4 external AV sources are possible (AV1, AV2/S-VHS1, AV3/S-VHS2 & YUV). The selection between these sources is done by IC7401 HEF4053.

Note: When S-VHS is inserted from the rear, AV2 source will be disabled. Likewise when S-VHS is inserted from the side-AV. The YUV is fed directly to video processor IC7301. This source selection is done internally by the IC.
The video processor IC7301 will decode the CVBS at pin-24 or pin-29 into YC signal and further process it into YUV signal and output at pin-40, 45 & 46. The IC7301 internal FM demodulator is used to produce mono audio and is available at the pin-8 of IC7301. This audio signal PIP-AUDIO is fed to the SSB sound processor as such that DW sound appeared at the headphone

DW/PIP processing
IC7801 SAB9081 is a multi-standard PIP controller, which can be used in double window or PIP applications. The YUV from the video processor IC7301 is fed to pin-79, 81 & 83. IC7801 will inserts YUV from the IC7301 with reduced size into the main picture YUV source in PIP environment. The main picture YUV is fed to pin-100, 2 & 98 respectively. These signals are mainly used during the DW mode.

Inside IC7801, the conversion to the digital environment is done on chip with ADCs. Processing and storage (1 MB DRAM) of the video data is done entirely in the digital domain. The conversion back to the analogue domain is done by DACs. Internal clocks are generated by PLLs, which lock on to the applied horizontal and vertical syncs from the main & sub pictures. The main picture syncs are applied to pin-70 (vert.) & pin-94 (hor.) and the sub picture syncs are applied to pin-72 (vert.) and pin-87 (hor.).
For DW mode, the main picture is compressed horizontally by a factor of two and directly fed to the output. After compression, a horizontal expansion of two is possible for the main picture. The sub picture is also compressed horizontally by a factor of two but stored in memory before it is fed to the outputs.

Post-processed YUV signals are fed to fast switching IC7803 TDA8601 pin-6, 7 & 8. In normal operation (w/o DW), the main picture YUV signals (at pin-2, 3 & 4) are bypassed by IC7803, and returned back to the main video processor. When DW mode is active, the compressed YUV signals (main & sub pictures) are used and fed to main video processor. During the PIP mode, only sub-picture YUV signals are used. The insertion control is made possible by fast blanking signal from IC7801 pin-68.

Power supplies
The power supplies used by DW panel are from the main board 5V, 8V and 33V (for tuner only). The 5V is regulated to +3.3V, +3V & +3VD by IC7802 LM317T. These voltages are mainly used by DW processor circuitry. The 8V is mainly supplied to IC7301 TDA888x IF + video processing circuitry and also to fast switching IC7803.

9.2 Abbreviation list

AARA	Automatic Aspect Ratio Adaptation: algorithm that adapts aspect ratio to remove horizontal black bars; keeping up the original aspect ratio
ACI	Automatic Channel Installation: algorithm that installs TV sets directly from cable network by means of a predefined TXT page
ADC	Analogue Digital Converter
AFC	Automatic Frequency Control: control signal used to tune to the correct frequency
AGC	Automatic Gain Control: algorithm that controls the video input of the featurebox
AI	Artificial Intelligence
AM	Amplitude Modulation
ANR	Automatic Noise Reduction: one of the algorithms of Auto TV
AR	Aspect Ratio: 4 by 3 or 16 by 9
ASF	Auto Screen Fit: algorithm that adapts aspect ratio to remove horizontal black bars but without throwing away video information
ATV	See Auto TV
AUDIO_C	Audio Centre
AUDIO_L	Audio Left
AUDIO_R	Audio Right
AUDIO_SL	Audio Surround Left
AUDIO_SW	Audio Subwoofer
AUDIO-L-PROC	Audio left processed
AUDIO-R-PROC	Audio right processed
AUDIO-SR	Audio surround right
Auto TV	Name for the combination of picture features/improvements, which work automatically (ANR/Auto sharpness/ Auto Histo/ambient light).
BC-PROT	Beam current protection
BG	System B and G
BLC-INFO	Black current information
B-SC1-IN	Blue EXT1 in
B-SC2-IN	Blue EXT2 in
B-TXT	Blue teletext
CENTER	Centre speaker
C-FRONT	Chrominance front input
CL	Constant Level: audio output to connect with an external amplifier
ComPair	Computer aided rePair
CRT	Cathode Ray Tube or picture tube
CSM	Customer Service Mode
CTI	Colour Transient Improvement: manipulates steepness of chroma transients
CVBS	Composite Video Blanking and Synchronisation
CVBS-SC1-IN	CVBS EXT1 in
CVBS-SC2 OUT	CVBS EXT2 out
CVBS-SC2-IN	CVBS EXT2 in
CVBS-SC3-IN	CVBS EXT3 in
CVBS-SC4-IN	CVBS EXT4 IN
CVBS-TER	CVBS terrestrial
CVBS-TXT-DS-OUT	CBVBS teletext Dual Screen out
CVBS-TXT-OUT	CVBS teletext out
CVBS-Y-FRONT	CVBS luminance front input
DAC-HOP	Digital analogue converter HOP IC
DBE	Dynamic Bass Enhancement: extra low frequency amplification
DC-filament	Filament supply voltage
DC-PROT	DC protection
DFU	Direction For Use: description for the end user
DNR	Digital Noise Reduction: noise reduction feature of the box
DSP	Digital Signal Processing
DST	Dealer Service Tool: special remote control designed for dealers to enter e.g. service mode
DVD	Digital Versatile Disc
DYN-FASE-COR	Dynamic phase correction
EHT	Extra High Tension
EHT-INFO	Extra High Tension information
EPG	Electronic Program Guide: system used by broadcasters to transmit TV guide information (= NexTView)
EW	East West, related to horizontal deflection of the set
EXT	External (source), entering the set via EXT or via cinches
FBL	Fast Blanking: DC signal accompanying RGB signals
FBL-SC1-IN	Fast blanking signal for EXT1 in
FBL-SC2-IN	Fast blanking signal for EXT2 in
FBL-TXT	Fast Blanking Teletext
FBX	Feature Box: part of small signal / separate module which contains 100 Hz processing, extra featuring and AutoTV algorithms
FEAT-U	U from Feature Box
FEAT-V	V from Feature Box
FEAT-Y	Y from Feature Box
FILAMENT	Filament of CRT
FLASH	Flash memory
FM	Field Memory or Frequency Modulation
FMS	Functional Module Specification: document that describes an isolated hardware function
FRONT-C	Front input chrominance (SVHS)
FRONT-DETECT	Front input detection
FRONT-Y_CVBS	Front input luminance or CVBS (SVHS)
FRS	Functional Requirement Specification: software specification document
G-SC1-IN	Green EXT1 in
G-SC2-IN	Green EXT2 in
G-TXT	Green teletext
HA	Horizontal Acquisition: horizontal sync pulse coming out of the HIP
HD100	Horizontal Drive: horizontal sync pulse coming out of the featurebox
HDTV	High Definition TV: highest resolution defined by the ATSC standard (1080 lines and 1920 horizontal pixels, referred to as 1080i) The second HDTV standard, 720p x 1280 is not used in EM1A chassis (3fH standard not feasible)
Headroom	Extra margin provision to avoid clipping of signals
HEATER	Heater (Filament)
HFB	Horizontal Flyback Pulse: horizontal sync pulse from large signal deflection
HFB+13V	Non rectified output 13V-winding LOT
HIP	High-end video Input Processor: video and chroma decoder of EM1A
HOP	High-end video Output Processor: video, sync and geometry controller of EM1A
HP	Headphone
HSI	Hardware Software Interface
IN-FRONT-SNDL	Sound left front in
IN-FRONT-SNDR	Sound right front in
IN-SC1-B	In EXT1 Blue

IN-SC1-G	In EXT1 Green
IN-SC1-R	In EXT1 Red
IN-SC1-SNDL	In EXT1 sound left
IN-SC1-SNDR	In EXT1 sound right
IN-SC2-B	In EXT2 Blue
IN-SC2-CVBS_Y	In EXT2 CVBS or luminance (SVHS)
IN-SC2-FBL	In EXT2 fast blanking
IN-SC2-G	In EXT2 Green
Interlaced	Scan mode where two fields are used to form one frame. Each field contains half the number of the total amount of lines. The fields are written in “pairs”, causing line flicker.
IO-BUS	In/Out - Bus
Last Status	The settings last chosen by the customer and read and stored in RAM or in the NVM. They are called at start-up of the set to configure it according the customers wishes
LDP	Line Deflection Protection
LED	Light Emitting Diode
LINE-DRIVE	Line drive signal
LNA	Low Noise Adapter
LSP	Large signal panel
MSP	Multistandard Sound Processor: ITT sound decoder of EM1A
MUTE	Mute-Line
NC	Not Connected
NDF	No vertical DeFlection: vertical flyback protection
NHF	No Horizontal deflection: horizontal flyback protection
NVM	Non Volatile Memory: IC containing TV related data e.g. alignments
O/C	Open Circuit
ON/OFF LED	On/Off control signal for the LED
OSD	On Screen Display
Painter	On screen display Teletext and Control; also named Artistic (SAA5800)
P50	Project 50 communication: protocol between TV and peripherals
PCB	Printed Circuit board
PICNIC	Peripheral Integrated Combined Network IC: main IC for 100 Hz featuring and feature processing
PILOT	Pilot Signal
PILOTMUTE	Pilot Mute signal
Progressive Scan	Scan mode where all scan lines are displayed in one frame at the same time, creating a double vertical resolution.
PTP	Picture Tube Panel
RAM	Random Access Memory
RC	Remote Control
RC5	RC5 signal from the remote control receiver
RESET	Reset signal
ROM	Read Only Memory
SAM	Service Alignment Mode
SC	Sandcastle: pulse derived from sync signals
SCAVEM	Scan Velocity Modulation
S/C	Short Circuit
SC1-OUT	EXT output of the MSP audio IC
SC2-B-IN	Scart2 Blue in
SC2-C-IN	Scart2 chrominance in
SC2-OUT	EXT output of the MSP audio IC
SIF	Sound Intermediate Frequency
SIMM	80-fold connector between LSP and SSB
SLDP	Smart Local Dooming Prevention (HW and SW)
SNDL-SC1-IN	Sound left EXT1 in
SNDL-SC1-OUT	Sound left EXT1 out
SNDL-SC2-IN	Sound left EXT2 in
SNDL-SC2-OUT	Sound left EXT2 out
SNDR-SC1-IN	Sound right EXT1 in
SNDR-SC1-OUT	Sound right EXT1 out
SNDR-SC2-IN	Sound right EXT2 out
SNDR-SC2-OUT	Sound right EXT2 out
SNDS-VL-OUT	Surround sound left variable level out
SNDS-VR-OUT	Surround sound right variable level out
SNERT	Synchronous No parity Eight bit Reception and Transmit
SSB	Small Signal Board
STBY	Standby
SW	Subwoofer
TXT	Teletext
TXT DS	Teletext Dual Screen
µP	microprocessor
VA	Vertical Acquisition
VBAT	main supply for deflection (mostly 141 V)
VD100	Vertical Drive: vertical sync pulse from deflection
VFB	Vertical Flyback Pulse: vertical sync pulse coming from the feature box
VL	Variable Level out: processed audio output towards external amplifier
WYSIWYR	What You See Is What You Record: record selection that follows main picture and sound
XTAL	Quartz crystal
Y-OUT	Luminance-signal to HOP IC

10. Spare parts list

[A] Large Signal Panel + [F] CRT Panel

Various

	3122 785 90260	Main Supply Repair Kit
	3122 785 90270	Standby Supply Repair Kit
	3122 785 90120	Line Supply Repair Kit
0010	2422 025 16374	2P male V
0020	4822 267 10774	2P male red
0029	3104 304 22832	Chassis frame
0032	4822 492 70788	Fix IC
0036	4822 265 20723	2P
0037	3104 304 21114	LOT SSB support
0045	4822 267 10734	5P
0050	4822 466 93461	20 X 25
0065	3104 304 22031	LOT Spacer EMG
0102	3104 304 21601	Support bracket AP
0125	3104 304 90361	Insulation plate EMG
0150	4822 265 11253	Fuse holder
0153	4822 265 11253	Fuse holder
0203	4822 265 30734	4P
0204	2422 025 04854	6P female V
0224	4822 265 41113	7P
0298	2422 500 80036	CRT V 9P female
0317	4822 265 20723	2P
0324	4822 265 41113	7P
0325	2422 025 16382	3P male V
0340	4822 267 10968	11P
0383	4822 267 10735	3P
0391	4822 267 10973	1P
0395	4822 492 70789	Fix transistor
0396	4822 492 70789	Fix transistor
0480	4822 492 70789	Fix transistor
0504	4822 492 63524	Fix transistor
0505	3122 121 24785	Spring for bracket
0620	4822 492 70789	Fix transistor
0750	3122 121 24785	Spring for bracket
0760	3122 121 24785	Spring for bracket
1001	4822 252 60151	Spark gap
1002	2422 132 07411	Relay 1P 5V 5A
1200	2422 542 90067	TUN V+U PLL PH Dk
1200	2422 542 90072	TUN TV V+U
1401	4822 071 51601	Fuse 160mA
1501	4822 070 34002	Fuse 4A
1503	4822 070 12502	Fuse 2.5A
1735	2422 025 16407	3P male V
1736	2422 025 16382	3P male V
1737	4822 267 10735	3P
1900	2422 026 05064	Cinch 12P female H
1901	2422 026 04926	4P female H
1920	4822 265 30735	5P
1921	2422 025 04851	3P
1922	2422 025 04851	3P
1923	2422 025 16599	80P female V
1936	2422 025 12485	11P male V
1937	4822 267 10557	10P
1940	4822 267 10968	11P
1943	4822 267 10748	3P
1945	4822 267 10735	3P
1946	5322 268 90415	2P
1947	4822 267 10734	5P
1948	4822 265 31215	3P

⊣⊢

2101	5322 122 32818	2n2F 10% 100V
2102	4822 124 81151	22µF 50V
2104	4822 123 14025	2200µF 20% 16V
2106	5322 126 10223	4n7F 10% 63V
2108	4822 121 70162	10nF 5% 400V
2109	4822 126 13482	470nF 20-80% 16V
2110	5322 121 42498	680nF 5% 63V
2111	4822 121 43526	47nF 5% 250V
2112	4822 124 11913	22nF 20% 275V
2113	4822 122 33127	2n2F 10% 63V
2114	4822 121 10711	100nF 20% 275V
2120	5322 121 42386	100nF 5% 63V
2200	4822 124 80195	470µF 20% 10V
2201	4822 126 14076	220nF 25V
2202	4822 126 13473	220nF 80-20% 50V
2203	4822 124 40433	47µF 20% 25V
2300	4822 124 40764	22µF 100 V
2301	4822 124 40196	220µF 20% 16V
2303	5322 122 31863	330pF 5% 63V
2304	4822 121 41856	22nF 5% 250V
2305	3198 017 44740	470nF 10V
2306	4822 126 14585	100nF 10% 50V
2307	5322 122 32654	22nF 10% 63V
2309	5322 122 32654	22nF 10% 63V
2313	4822 124 11565	10µF 20% 250V
2315	4822 122 33216	270pF 5% 50V
2316	4822 121 40518	100nF 10% 250V
2317	5322 121 44356	4n7F 5% 2kV
2318	5322 122 32654	22nF 10% 63V
2319	4822 122 30043	10nF 80% 63V
2320	4822 126 13838	100nF 20-80% 50V
2325	4822 126 14585	100nF 10% 50V
2400	4822 124 11575	7µF 20% 160V
2402	4822 126 13599	3n3F 10% 500V
2411	4822 126 14585	100nF 10% 50V
2412	4822 126 13751	47nF 10% 63V
2413	4822 124 12255	10µF 20% 50V
2414	4822 126 13751	47nF 10% 63V
2415	4822 122 33575	220pF 5% 63V
2416	4822 126 14133	1nF 20% 250V
2417	4822 126 14076	220nF 25V
2419	4822 126 14237	470pF 10% 2kV
2420	4822 121 70595	1n2F 5% 2kV
2421	4822 121 42634	560nF 5% 250V
2424	4822 126 10206	2n2F 10% 500V
2425	4822 121 10526	9n1F 5% 2kV
2426	2222 375 90218	18nF 5% 630V
2429	4822 121 43343	4n7F 10% 400V
2430	4822 121 41857	10nF 5% 250V
2431	4822 126 10206	2n2F 10% 500V
2433	2222 479 90022	0.43µF 250V
2446	5322 122 32268	470pF 10% 50V
2447	5322 122 32268	470pF 10% 50V
2448	5322 122 32268	470pF 10% 50V
2450	5322 121 42578	100nF 5% 250V
2455	5322 122 34099	470pF 10% 63V
2459	4822 122 31177	470pF 10% 500V
2460	4822 124 40784	3300µF 20% 16V
2461	4822 122 31177	470pF 10% 500V
2462	4822 124 80061	1000µF 20% 25V
2463	4822 122 31177	470pF 10% 500V
2464	4822 124 80061	1000µF 20% 25V
2465	4822 122 31177	470pF 10% 500V
2466	4822 124 41584	100µF 20% 10V
2467	4822 124 41584	100µF 20% 10V
2468	4822 124 12297	4.7µF 20% 350V
2469	4822 122 31169	1n5F 10% 500V
2471	2222 460 90025	18nF 2% 63V
2480	4822 121 43856	4n7F 5% 250V
2485	2222 460 90022	10nF 2% 63V
2489	4822 124 40433	47µF 20% 25V
2492	4822 126 14076	220nF 25V
2493	5322 122 32654	22nF 10% 63V
2494	4822 126 14076	220nF 25V
2495	4822 126 14076	220nF 25V
2496	4822 126 13838	100nF 20-80% 50V
2497	4822 126 14076	220nF 25V
2498	4822 126 14585	100nF 10% 50V
2499	4822 122 33891	3.3nF10% 63V
2501	4822 126 14588	2n2F 10% 1kV
2502	5322 122 32818	2n2F 10% 100V
2503	5322 121 42489	33nF 5% 250V
2505	2020 554 90148	470pF 20% 250V
2506	4822 121 43913	470nF 10% 100V
2507	4822 126 13589	470nF 275V
2508	4822 124 11913	22nF 20% 275V
2509	4822 124 11913	22nF 20% 275V
2510	4822 124 12415	20µF 20% 400V
2512	4822 124 12056	1000µF 20% 35V
2513	5322 122 34099	470pF 10% 63V
2514	5322 122 31863	330pF 5% 63V
2515	2020 021 91543	47µF 20% 160V
2518	4822 126 13249	150pF 10% 500V
2519	5322 122 32818	2n2F 10% 100V
2520	4822 126 14585	100nF 10% 50V
2521	4822 122 33216	270pF 5% 50V
2528	4822 126 14585	100nF 10% 50V
2530	4822 126 14585	100nF 10% 50V
2531	4822 122 31169	1n5F 10% 500V
2536	4822 124 21913	1µF 20% 63V
2538	5322 126 10223	4n7F 10% 63V
2601	4822 121 51319	1µF 10% 63V
2602	4822 124 81151	22µF 50V
2603	2020 552 95447	16V 2U2
2604	4822 124 40248	10µF 20% 63V
2607	4822 124 40769	4.7µF 20% 100V
2609	4822 124 40196	220µF 20% 16V
2610	4822 122 33127	2n2F 10% 63V
2620	4822 126 14076	220nF 25V
2621	4822 126 13838	100nF 20-80% 50V
2622	4822 124 40255	100µF 20% 63V
2624	4822 121 51252	470nF 5% 63V
2625	4822 121 51252	470nF 5% 63V
2627	5322 124 40641	10µF 20% 100V
2639	2238 780 15654	220n 10% 16V
2640	4822 124 21913	1µF 20% 63V
2642	4822 124 40255	100µF 20% 63V
2653	5322 126 10511	1nF 5% 50V
2704	4822 124 41751	47µF 20% 50V
2730	4822 124 81151	22µF 50V
2731	4822 124 81151	22µF 50V
2732	4822 124 40255	100µF 20% 63V
2733	4822 124 40255	100µF 20% 63V
2734	4822 124 81151	22µF 50V
2735	4822 124 81151	22µF 50V
2738	4822 124 80791	470µF 16V 20%
2739	4822 124 80791	470µF 16V 20%
2756	4822 126 13751	47nF 10% 63V
2758	4822 124 40769	4.7µF 20% 100V
2759	4822 124 40769	4.7µF 20% 100V
2760	4822 124 80061	1000µF 20% 25V
2761	4822 124 80061	1000µF 20% 25V
2762	4822 124 80061	1000µF 20% 25V
2765	4822 124 40255	100µF 20% 63V
2766	4822 124 40255	100µF 20% 63V
2767	4822 124 80144	220µF 20% 25V
2768	4822 124 80144	220µF 20% 25V
2775	4822 126 13751	47nF 10% 63V
2776	4822 126 13751	47nF 10% 63V
2782	4822 126 13751	47nF 10% 63V
2784	4822 121 43526	47nF 5% 250V
2785	4822 121 43526	47nF 5% 250V
2786	5322 121 42498	680nF 5% 63V
2906	5322 122 32531	100pF 5% 50V
2910	5322 122 32531	100pF 5% 50V
2912	4822 124 40248	10µF 20% 63V
2913	4822 126 14585	100nF 10% 50V
2917	5322 122 32531	100pF 5% 50V
2920	5322 122 32531	100pF 5% 50V
2923	5322 122 31863	330pF 5% 63V
2925	5322 122 31863	330pF 5% 63V
2926	4822 124 11767	470µF 20% 25V
2927	4822 124 41751	47µF 20% 50V
2928	4822 126 13482	470nF 20-80% 16V
2941	5322 122 31865	1n5F 10% 63V
2942	5322 122 31865	1n5F 10% 63V
2944	4822 121 10779	1n5F 10% 50V
2946	5322 122 31865	1n5F 10% 63V
2951	4822 124 21913	1µF 20% 63V
2952	4822 126 13751	47nF 10% 63V
2953	4822 126 13751	47nF 10% 63V

⊣▭⊢

3101	4822 053 20106	10M 5% 0.25W
3102	4822 050 26801	680Ω 1% 0.6W
3103	4822 050 26801	680Ω 1% 0.6W
3104	4822 116 52195	47Ω 5% 0.5W
3105	4822 050 26801	680Ω 1% 0.6W
3106	4822 050 11002	1k 1% 0.4W
3107	4822 050 11002	1k 1% 0.4W
3108	4822 116 52176	10Ω 5% 0.5W
3109	4822 051 20109	10Ω 5% 0.1W
3110	4822 052 10109	10Ω 5% 0.33W
3113	4822 116 52186	22Ω 5% 0.5W
3114	4822 116 83872	220Ω 5% 0.5W
3117	4822 116 52195	47Ω 5% 0.5W
3118	4822 050 24708	4Ω7 1% 0.6W
3120	4822 051 20109	10Ω 5% 0.1W
3123	4822 116 52176	10Ω 5% 0.5W
3124	4822 116 52199	68Ω 5% 0.5W
3125	4822 116 52182	15Ω 5% 0.5W
3126	4822 050 21003	10k 1% 0.6W
3127	4822 116 52289	5k6 5% 0.5W
3130	4822 116 52195	47Ω 5% 0.5W
3200	4822 051 20101	100Ω 5% 0.1W
3201	4822 051 20101	100Ω 5% 0.1W
3202	4822 050 11002	1k 1% 0.4W
3203	4822 051 10102	1k 2% 0.25W
3230	4822 053 11223	22k 5% 2W
3300	4822 052 10109	10Ω 5% 0.33W
3301	4822 053 12472	4k7 5% 3W
3303	4822 117 10965	18k 1% 0.1W
3304	4822 051 10102	1k 2% 0.25W
3307	4822 051 20109	10Ω 5% 0.1W
3308	4822 117 11148	56k 1% 0.1W
3309	4822 117 10353	150Ω 1% 0.1W
3310	4822 051 10102	1k 2% 0.25W
3311	4822 051 20479	47Ω 5% 0.1W
3312	4822 117 11449	2k2 5% 0.1W

3316	4822 117 11148	56k 1% 0.1W
3318	4822 051 20478	4Ω7 5% 0.1W
3319	4822 051 10102	1k 2% 0.25W
3321	4822 053 12472	4k7 5% 3W
3322	4822 051 20101	100Ω 5% 0.1W
3334	4822 050 11002	1k 1% 0.4W
3335	4822 051 10102	1k 2% 0.25W
3336	4822 051 10102	1k 2% 0.25W
3337	4822 051 10102	1k 2% 0.25W
3338	3198 013 01020	1k 20% 0.5W
3339	3198 013 01020	1k 20% 0.5W
3340	3198 013 01020	1k 20% 0.5W
3341	4822 052 10151	150Ω 5% 0.33W
3342	4822 051 20471	470Ω 5% 0.1W
3343	4822 050 22202	2k2 1% 0.6W
3345	4822 116 52191	33Ω 5% 0.5W
3347	3198 013 01520	1k5 20% 0.5W
3348	4822 050 22202	2k2 1% 0.6W
3349	3198 013 01020	1k 20% 0.5W
3350	4822 116 83883	470Ω 5% 0.5W
3351	4822 116 83883	470Ω 5% 0.5W
3352	4822 116 83883	470Ω 5% 0.5W
3354	4822 117 11449	2k2 5% 0.1W
3355	4822 051 20478	4Ω7 5% 0.1W
3356	4822 051 10102	1k 2% 0.25W
3357	4822 051 20478	4Ω7 5% 0.1W
3358	4822 117 11139	1k5 1% 0.1W
3365	4822 051 20478	4Ω7 5% 0.1W
3402	4822 117 10837	100k 1% 0.1W
3403	4822 051 20101	100Ω 5% 0.1W
3404	4822 051 20471	470Ω 5% 0.1W
3406	4822 051 20101	100Ω 5% 0.1W
3407	4822 117 10833	10k 1% 0.1W
3408	4822 117 11504	270Ω 1% 0.1W
3409	4822 050 11002	1k 1% 0.4W
3410	4822 051 20479	47Ω 5% 0.1W
3411	4822 116 52193	39Ω 5% 0.5W
3414	4822 117 13577	330Ω 1% 1.25W
3415	3198 012 31590	15Ω 5% 3W
3417	4822 116 52176	10Ω 5% 0.5W
3418	4822 050 23303	33k 1% 0.6W
3431	4822 052 10331	330Ω 5% 0.33W
3450	4822 116 52238	12k 5% 0.5W
3451	4822 116 52303	8k2 5% 0.5W
3460	4822 052 10108	1Ω 5% 0.33W
3461	4822 052 10108	1Ω 5% 0.33W
3462	4822 052 10108	1Ω 5% 0.33W
3463	4822 052 10108	1Ω 5% 0.33W
3464	4822 052 11108	1Ω 5% 0.5W
3465	4822 052 11108	1Ω 5% 0.5W
3466	4822 052 10228	2Ω2 5% 0.33W
3467	4822 052 10228	2Ω2 5% 0.33W
3468	4822 052 11688	6Ω8 5% 0.5W
3469	4822 116 52175	100Ω 5% 0.5W
3470	4822 051 20472	4k7 5% 0.1W
3471	4822 117 11507	6k8 1% 0.1W
3472	4822 051 20393	39k 5% 0.1W
3473	4822 117 10834	47k 1% 0.1W
3474	4822 117 10833	10k 1% 0.1W
3476	4822 116 83874	220k 5% 0.5W
3477	4822 117 10833	10k 1% 0.1W
3478	4822 117 11503	220Ω 1% 0.1W
3481	4822 116 52175	100Ω 5% 0.5W
3484	4822 051 10102	1k 2% 0.25W
3485	4822 051 10102	1k 2% 0.25W
3486	4822 051 20472	4k7 5% 0.1W
3487	4822 051 20223	22k 5% 0.1W
3489	4822 117 11449	2k2 5% 0.1W
3490	4822 051 20223	22k 5% 0.1W
3495	4822 050 23303	33k 1% 0.6W
3496	4822 050 11002	1k 1% 0.4W
3497	4822 051 20101	100Ω 5% 0.1W
3498	4822 051 10102	1k 2% 0.25W
3499	4822 051 20101	100Ω 5% 0.1W
3500	4822 117 12074	1Ω5 10% 7W
3501	3198 013 04710	470Ω 20% 0.5W
3504	4822 116 83883	470Ω 5% 0.5W
3505	4822 051 20683	68k 5% 0.1W
3506	4822 117 10834	47k 1% 0.1W
3507	4822 050 21604	160k 1% 0.6W
3508	3198 012 16820	6.8k.1W
3509	2322 595 90022	VDR DC 1mA/612V
3510	4822 117 11951	2k 1% 0.1W
3511	4822 116 52276	3k9 5% 0.5W
3512	4822 116 52297	68k 5% 0.5W
3513	4822 116 52272	330k 5% 0.5W
3514	3198 012 16870	0Ω68 5% 1W
3515	2322 193 53128	1Ω2 5%
3516	4822 116 10075	9Ω 220V
3517	4822 051 20472	4k7 5% 0.1W
3518	4822 116 52234	100k 5% 0.5W
3519	4822 051 20223	22k 5% 0.1W
3520	4822 053 11333	33k 5% 2W
3521	4822 117 10118	1M 5% 0.5W
3522	4822 116 83961	6k8 5%
3523	4822 051 20105	1M 5% 0.1W
3524	4822 051 10102	1k 2% 0.25W
3525	4822 051 20479	47Ω 5% 0.1W
3526	4822 116 83303	10Ω 2W
3527	4822 117 11454	820Ω 1% 0.1W
3528	4822 117 10833	10k 1% 0.1W
3529	4822 051 20472	4k7 5% 0.1W
3530	4822 116 52297	68k 5% 0.5W
3531	4822 117 10833	10k 1% 0.1W
3533	4822 051 20159	15Ω 5% 0.1W
3535	4822 051 20184	180k 5% 0.1W
3536	4822 051 20684	680k 5% 0.1W
3537	4822 051 20223	22k 5% 0.1W
3540	4822 117 10834	47k 1% 0.1W
3542	3198 012 11570	0Ω15 5% 1W
3543	4822 117 11504	270Ω 1% 0.1W
3544	4822 051 20479	47Ω 5% 0.1W
3545	4822 051 20471	470Ω 5% 0.1W
3600	4822 050 24704	470k 1% 0.6W
3601	4822 050 24704	470k 1% 0.6W
3602	4822 051 20822	8k2 5% 0.1W
3603	4822 101 11186	470Ω 30% lin 0.1W
3604	4822 051 20471	470Ω 5% 0.1W
3605	4822 051 20273	27k 5% 0.1W
3606	4822 051 10102	1k 2% 0.25W
3607	4822 051 20223	22k 5% 0.1W
3608	4822 051 20223	22k 5% 0.1W
3609	4822 101 11192	22k 30% lin 0.1W
3610	4822 051 20333	33k 5% 0.1W
3612	4822 051 20274	270k 5% 0.1W
3613	4822 051 20274	270k 5% 0.1W
3614	4822 050 21504	150k 1% 0.6W
3615	4822 116 52292	560k 5% 0.5W
3616	4822 116 52285	470k 5% 0.5W
3617	4822 050 11002	1k 1% 0.4W
3618	4822 051 10102	1k 2% 0.25W
3619	4822 051 20562	5k6 5% 0.1W
3620	4822 116 80176	1Ω 5% 0.5W
3621	4822 116 80176	1Ω 5% 0.5W
3622	4822 116 80176	1Ω 5% 0.5W
3623	4822 051 20223	22k 5% 0.1W
3624	4822 052 10158	1Ω5 5% 0.33W
3625	4822 116 83872	220Ω 5% 0.5W
3626	4822 116 83872	220Ω 5% 0.5W
3627	4822 116 52238	12k 5% 0.5W
3628	5322 116 53564	3Ω3 5% 0.5W
3630	4822 051 10102	1k 2% 0.25W
3631	4822 051 20472	4k7 5% 0.1W
3632	4822 117 10833	10k 1% 0.1W
3633	4822 117 11449	2k2 5% 0.1W
3639	4822 051 20105	1M 5% 0.1W
3640	4822 116 52257	22k 5% 0.5W
3641	4822 117 10833	10k 1% 0.1W
3642	4822 117 10833	10k 1% 0.1W
3643	4822 051 20223	22k 5% 0.1W
3644	4822 117 10833	10k 1% 0.1W
3645	4822 116 52272	330k 5% 0.5W
3652	4822 051 20101	100Ω 5% 0.1W
3653	4822 051 20472	4k7 5% 0.1W
3661	4822 051 10102	1k 2% 0.25W
3662	4822 051 20225	2M2 5% 0.1W
3663	4822 051 20332	3k3 5% 0.1W
3665	4822 051 20684	680k 5% 0.1W
3701	4822 117 10833	10k 1% 0.1W
3702	4822 117 10833	10k 1% 0.1W
3703	4822 117 10833	10k 1% 0.1W
3705	4822 051 20122	1k2 5% 0.1W
3706	4822 051 20122	1k2 5% 0.1W
3707	4822 051 20122	1k2 5% 0.1W
3708	4822 116 83961	6k8 5%
3710	4822 051 10102	1k 2% 0.25W
3711	4822 117 10833	10k 1% 0.1W
3714	4822 051 20472	4k7 5% 0.1W
3715	4822 051 10102	1k 2% 0.25W
3716	4822 117 11139	1k5 1% 0.1W
3717	4822 051 20472	4k7 5% 0.1W
3718	4822 116 52243	1k5 5% 0.5W
3719	4822 051 10102	1k 2% 0.25W
3730	4822 117 10833	10k 1% 0.1W
3731	4822 117 10833	10k 1% 0.1W
3732	4822 051 20822	8k2 5% 0.1W
3733	4822 051 20822	8k2 5% 0.1W
3734	4822 117 10834	47k 1% 0.1W
3735	4822 117 10834	47k 1% 0.1W
3736	4822 051 10102	1k 2% 0.25W
3737	4822 051 10102	1k 2% 0.25W
3738	4822 117 11148	56k 1% 0.1W
3739	4822 117 11148	56k 1% 0.1W
3740	4822 051 20683	68k 5% 0.1W
3741	4822 051 20683	68k 5% 0.1W
3742	4822 116 52199	68Ω 5% 0.5W
3743	4822 116 52199	68Ω 5% 0.5W
3744	4822 117 11503	220Ω 1% 0.1W
3745	4822 117 11503	220Ω 1% 0.1W
3750	4822 117 10834	47k 1% 0.1W
3756	4822 117 10833	10k 1% 0.1W
3757	4822 117 10837	100k 1% 0.1W
3758	4822 117 10837	100k 1% 0.1W
3762	4822 051 20828	8Ω2 5% 0.1W
3763	4822 117 10837	100k 1% 0.1W
3765	4822 117 11507	6k8 1% 0.1W
3770	4822 117 10834	47k 1% 0.1W
3773	4822 051 20154	150k 5% 0.1W
3784	4822 051 20828	8Ω2 5% 0.1W
3789	4822 051 20828	8Ω2 5% 0.1W
3790	4822 051 20822	8k2 5% 0.1W
3792	4822 051 20822	8k2 5% 0.1W
3794	4822 116 52195	47Ω 5% 0.5W
3798	4822 116 52249	1k8 5% 0.5W
3908	4822 116 52201	75Ω 5% 0.5W
3909	4822 116 52201	75Ω 5% 0.5W
3910	4822 051 20101	100Ω 5% 0.1W
3911	4822 116 52201	75Ω 5% 0.5W
3913	4822 116 52201	75Ω 5% 0.5W
3915	4822 116 52201	75Ω 5% 0.5W
3919	4822 051 10102	1k 2% 0.25W
3920	4822 051 10102	1k 2% 0.25W
3925	4822 052 10688	6Ω8 5% 0.33W
3928	4822 051 20101	100Ω 5% 0.1W
3929	4822 117 10833	10k 1% 0.1W
3930	4822 051 20561	560Ω 5% 0.1W
3932	4822 116 52201	75Ω 5% 0.5W
3935	4822 116 52201	75Ω 5% 0.5W
3936	4822 117 10353	150Ω 1% 0.1W
3937	4822 117 10353	150Ω 1% 0.1W
3940	4822 117 10353	150Ω 1% 0.1W
3941	4822 117 10353	150Ω 1% 0.1W
3944	4822 051 10102	1k 2% 0.25W
3946	4822 051 10102	1k 2% 0.25W
3950	4822 116 52249	1k8 5% 0.5W
3970	4822 051 20121	120Ω 5% 0.1W
3971	4822 117 10833	10k 1% 0.1W
3972	4822 117 10833	10k 1% 0.1W
3991	4822 116 52175	100Ω 5% 0.5W
3992	4822 116 52175	100Ω 5% 0.5W
3993	4822 051 20101	100Ω 5% 0.1W
3995	4822 116 52175	100Ω 5% 0.5W
3996	4822 116 52175	100Ω 5% 0.5W
3997	4822 116 52175	100Ω 5% 0.5W
4xxx	4822 051 10008	0Ω 5% 0.25W
4xxx	4822 051 20008	0Ω 5% 0.25W

⌐∿¬

5101	8204 000 73591	TFM standby
5102	4822 157 70436	8.2µH
5103	4822 526 10704	Bead 100mHz
5104	4822 157 11411	Bead 100mHz
5105	4822 157 11411	Bead 100mHz
5110	4822 157 11411	Bead 100mHz
5115	4822 157 11411	Bead 100mHz
5120	3198 018 16870	680nF 10%
5200	4822 157 11775	6.8µH 5%
5203	4822 157 71206	Coil
5204	4822 157 71206	Coil
5205	4822 157 71206	Coil
5400	4822 157 11869	33µH 10%
5410	2422 531 02447	TFM sig driver
5411	4822 157 71097	0.56µH
5421	2422 536 00102	Coil lincor 6µH
5422	2422 531 02357	Bridge coil
5426	4822 157 70826	2.4µH
5430	3128 138 21091	TFM LOT slot
5461	4822 157 11411	Bead 100mHz
5463	4822 157 11411	Bead 100mHz
5465	4822 157 11411	Bead 100mHz
5466	4822 157 11869	33µH 10%
5467	4822 157 11411	Bead 100mHz
5468	4822 157 11737	22µH 10%
5469	3198 018 11890	18U 5%
5494	4822 157 11855	68µH 10%
5502	4822 157 11411	Bead 100mHz
5504	2422 549 43286	Bridge coil
5505	4822 157 11411	Bead 100mHz
5506	2422 531 98042	TFM SMT
5510	4822 157 11411	Bead 100mHz
5620	4822 157 11771	0.09µH 10%

→|←

6103	4822 130 42488	BYD33D
6105	4822 130 34281	BZX79-B15
6106	4822 130 34398	BZX79-B24
6108	4822 130 30621	1N4148
6109	4822 130 31083	BYW55

6111	4822 130 83865	SB360
6120	4822 130 30621	1N4148
6121	4822 130 30621	1N4148
6122	3198 010 53980	BZX79-B3V9
6200	9322 149 10685	BZM55-C33
6204	9322 129 38685	BZM55-C6V8
6205	9322 129 38685	BZM55-C6V8
6206	9322 129 38685	BZM55-C6V8
6207	9322 129 38685	BZM55-C6V8
6305	4822 130 30842	BAV21
6306	4822 130 30842	BAV21
6307	4822 130 30842	BAV21
6308	4822 130 83757	BAS216
6309	4822 130 83757	BAS216
6310	4822 130 83757	BAS216
6405	9322 149 10685	BZM55-C33
6406	4822 130 83757	BAS216
6407	4822 130 83757	BAS216
6408	4822 130 42488	BYD33D
6421	4822 130 10753	BY359X-1500
6422	4822 130 10218	BY229X-800
6442	9322 129 42685	BZM55-C15
6461	4822 130 83796	BYV29F-500
6463	4822 130 83796	BYV29F-500
6465	4822 130 83796	BYV29F-500
6466	4822 130 83796	BYV29F-500
6468	4822 130 42488	BYD33D
6480	4822 130 42488	BYD33D
6481	4822 130 31024	BZX79-B18
6482	4822 130 83757	BAS216
6492	4822 130 83757	BAS216
6493	4822 130 11594	BZX284-C47
6499	9322 129 39685	BZM55-C8V2
6504	4822 130 10741	GBU6J
6505	4822 130 34281	BZX79-B15
6506	4822 130 30621	1N4148
6507	9340 550 66112	BYV28-200/24
6508	4822 130 11415	BYV28-400/20
6510	4822 130 34281	BZX79-B15
6511	4822 130 83757	BAS216
6512	4822 130 83757	BAS216
6514	5322 130 31932	BZT03-C200
6515	4822 130 32904	BZV85-C5V6
6516	4822 130 83757	BAS216
6517	4822 130 31983	BAT85
6518	4822 130 83757	BAS216
6519	4822 130 42488	BYD33D
6600	4822 130 30621	1N4148
6616	4822 130 83757	BAS216
6619	4822 130 42488	BYD33D
6620	5322 130 31938	BYV27-200
6623	4822 130 83757	BAS216
6660	4822 130 31983	BAT85
6665	4822 130 83757	BAS216
6731	4822 130 83757	BAS216
6732	4822 130 83757	BAS216

7100	4822 130 44568	BC557B
7101	4822 130 40959	BC547B
7102	4822 130 11417	STP3NB60FP
7104	4822 130 11418	TCDT1102G
7228	4822 209 73852	PMBT2369
7300	4822 130 44154	BF199
7301	5322 130 60159	BC846B
7302	5322 130 41888	BD140-16
7303	5322 130 41886	BD139-16
7304	4822 130 60373	BC856B
7307	9352 561 40112	TDA6108
7407	5322 130 60159	BC846B
7408	5322 130 44647	BC368
7409	5322 130 60159	BC846B
7421	9340 210 30127	BU2520DX
7440	4822 209 70672	LM358N
7480	4822 130 11417	STP3NB60FP
7481	4822 130 44568	BC557B
7482	4822 130 11418	TCDT1102G
7501	4822 130 60373	BC856B
7502	4822 130 61675	BF487
7504	9322 126 65687	STP5NB60FP
7505	4822 130 60373	BC856B
7506	4822 209 14933	TL431IZ
7510	5322 130 60159	BC846B
7528	4822 130 40981	BC337-25
7529	5322 130 60159	BC846B
7600	4822 130 44461	BC546B
7602	5322 130 60159	BC846B
7603	4822 130 60373	BC856B
7605	5322 130 60159	BC846B
7606	5322 130 60159	BC846B
7610	4822 130 11418	TCDT1102G
7620	4822 209 90009	TDA8177
7640	5322 130 60159	BC846B
7641	5322 130 60159	BC846B
7652	5322 130 60159	BC846B
7653	5322 130 60159	BC846B
7654	4822 130 60373	BC856B
7655	5322 130 60159	BC846B
7701	5322 130 60159	BC846B
7702	5322 130 60159	BC846B
7720	5322 130 60159	BC846B
7721	5322 130 60159	BC846B
7722	4822 130 60373	BC856B
7723	4822 130 60373	BC856B
7724	5322 130 60159	BC846B
7725	5322 130 60159	BC846B
7730	5322 130 60159	BC846B
7731	4822 130 60373	BC856B
7732	5322 130 60159	BC846B
7733	5322 130 60159	BC846B
7740	4822 209 32269	TDA2616/N1
7750	4822 209 32269	TDA2616/N1
7901	4822 130 40959	BC547B
7905	5322 130 44647	BC368
7906	4822 209 12334	L4940V85
7907	5322 130 60159	BC846B
8001	4822 320 20233	cable
8036	3104 311 01421	2P3 220mm
8203	3104 311 02441	4P 400mm
8204	3104 311 02521	6P 280mm
8317	3104 311 01421	2P3 220mm
8324	3104 311 01881	7P 480mm
8325	4822 320 20189	EHT cable
8326	4822 320 20216	EHT cable
8340	3104 311 02321	11P 400mm
8400	2422 025 16691	3P 2.5mm H
8501	3104 311 01892	JST 560mm
8737	3104 311 01101	3P 1m
8920	3104 311 02511	5P 280mm
8921	3104 311 01831	3P 280mm
8922	3104 311 01831	3P 280mm
8937	3104 311 02071	10P 280mm
9312	4822 051 20008	Jumper

[B] Small Signal Board

Various

0002	3104 301 23991	Shielding frame
0003	3104 301 24001	Shielding top cover
0026	3104 301 24011	Shielding bottom cover
0302	2422 025 16542	2P male V
1001	2422 543 89018	Crystal 12MHz
1020	3104 328 06281	SSB multi AP virtual DS
1020	3104 328 06291	SSB China virtual DS
1020	3104 328 10991	SSB Middle East virtual DS
1301	2422 540 98456	Crystal 12MHz
1309	2422 543 01184	Crystal 4.433619MHz
1310	2422 543 01183	Crystal 3.579545MHz
1405	2422 549 44374	Saw Filter OFWK9352L
1405	2422 549 44389	Saw Filter OFWK9361L
1406	2422 549 44324	Crystal 5.5-5.74MHz
1407	2422 549 44043	Crystal 4MHz
1408	2422 549 44376	Saw Filter
1408	2422 549 44388	Saw Filter
1409	2422 549 44373	Saw Filter OFWK3955L
1651	2422 543 89019	Crystal 18.432MHz
1681	2422 025 16835	3P male H
1682	2422 025 16729	10P female V
1701	2422 543 89018	Crystal 12MHz

2001	4822 126 11671	33pF
2002	4822 126 11671	33pF
2004	4822 126 14305	100nF 10% 16V
2005	4822 126 14305	100nF 10% 16V
2006	4822 126 14305	100nF 10% 16V
2007	4822 126 14305	100nF 10% 16V
2008	4822 126 14305	100nF 10% 16V
2010	4822 122 33777	47pF 5% 63V
2011	4822 122 33777	47pF 5% 63V
2012	4822 122 33777	47pF 5% 63V
2013	4822 124 12095	100µF 20% 16V
2014	4822 126 14305	100nF 10% 16V
2015	4822 126 14305	100nF 10% 16V
2016	4822 124 12095	100µF 20% 16V
2017	4822 126 14305	100nF 10% 16V
2020	5322 126 11583	10nF 10% 50V
2030	4822 126 14305	100nF 10% 16V
2031	4822 126 14305	100nF 10% 16V
2300	4822 124 12095	100µF 20% 16V
2301	3198 017 41050	1µF 10V
2302	4822 126 14305	100nF 10% 16V
2303	5322 126 11583	10nF 10% 50V
2304	4822 122 33741	10pF 10% 50V
2306	4822 126 13881	470pF 5% 50V
2307	4822 126 14305	100nF 10% 16V
2308	4822 122 33741	10pF 10% 50V
2313	4822 121 70159	0.1µF 16V
2314	4822 124 12095	100µF 20% 16V
2315	4822 126 14305	100nF 10% 16V
2317	4822 126 14491	2.2µF 10V
2318	4822 126 14494	22nF 10% 25V
2319	5322 126 11583	10nF 10% 50V
2320	4822 122 33741	10pF 10% 50V
2321	4822 126 14305	100nF 10% 16V
2322	4822 126 14305	100nF 10% 16V
2323	4822 126 14305	100nF 10% 16V
2324	5322 126 11583	10nF 10% 50V
2325	4822 126 14305	100nF 10% 16V
2328	4822 122 33761	22pF 5% 50V
2329	4822 126 14305	100nF 10% 16V
2330	4822 126 14305	100nF 10% 16V
2331	4822 126 14305	100nF 10% 16V
2332	4822 126 14305	100nF 10% 16V
2333	4822 126 14491	2.2µF 10V
2334	4822 126 14491	2.2µF 10V
2335	4822 124 80349	47µF 20% 6.3V
2336	4822 126 14491	2.2µF 10V
2338	5322 126 11583	10nF 10% 50V
2340	4822 124 23002	10µF 16V
2341	4822 124 12095	100µF 20% 16V
2342	4822 126 14305	100nF 10% 16V
2343	4822 126 14305	100nF 10% 16V
2350	4822 126 14305	100nF 10% 16V
2351	4822 126 14305	100nF 10% 16V
2352	4822 126 14305	100nF 10% 16V
2353	4822 126 14305	100nF 10% 16V
2354	4822 126 14305	100nF 10% 16V
2356	4822 126 14305	100nF 10% 16V
2357	4822 126 14305	100nF 10% 16V
2358	5322 126 11579	3n3F 10% 63V
2359	4822 122 33752	15pF 5% 50V
2360	3198 016 31280	1p5F 50V
2361	3198 016 31280	1p5F 50V
2362	4822 126 11663	12pF
2365	4822 126 14305	100nF 10% 16V
2366	4822 126 14305	100nF 10% 16V
2367	4822 126 14305	100nF 10% 16V
2368	4822 126 14305	100nF 10% 16V
2369	4822 126 14305	100nF 10% 16V
2370	4822 126 14305	100nF 10% 16V
2371	4822 126 13193	4n7F 10% 63V
2372	4822 126 14043	1µF 20-80% 16V
2373	4822 126 14305	100nF 10% 16V
2374	4822 126 14491	2.2µF 10V
2375	4822 126 14494	22nF 10% 25V
2376	4822 126 14305	100nF 10% 16V
2377	4822 124 12095	100µF 20% 16V
2378	4822 126 14305	100nF 10% 16V
2384	4822 126 14305	100nF 10% 16V
2385	4822 126 14305	100nF 10% 16V
2409	4822 126 14491	2.2µF 10V
2410	4822 126 14472	1µF 10% 10V
2411	4822 126 14305	100nF 10% 16V
2412	4822 126 13193	4n7F 10% 63V
2413	4822 124 80151	47µF 16V
2417	3198 017 44740	470nF 10V
2418	3198 016 38280	8p2F 50V
2418	4822 122 33741	10pF 10% 50V
2420	4822 122 33753	150pF 5% 50V
2422	4822 126 14305	100nF 10% 16V
2424	4822 126 14305	100nF 10% 16V
2425	4822 124 12095	100µF 20% 16V
2426	4822 126 14305	100nF 10% 16V
2501	4822 122 33777	47pF 5% 63V
2502	4822 122 32927	20nF 20-80% 50V
2503	4822 122 32927	20nF 20-80% 50V
2504	4822 122 32927	20nF 20-80% 50V
2505	4822 122 32927	20nF 20-80% 50V
2508	2020 021 91557	100µF 20% 16V
2509	4822 122 33752	15pF 5% 50V
2510	4822 122 33752	15pF 5% 50V
2550	4822 126 14241	50V 330P
2602	4822 126 14107	330nF 20-80% 25V
2603	4822 126 14107	330nF 20-80% 25V
2604	4822 126 14107	330nF 20-80% 25V
2605	4822 126 14305	100nF 10% 16V
2609	3198 016 31020	1nF 25V
2610	4822 126 14238	50V 2N2
2611	5322 126 11578	1nF 10% 50V
2629	4822 126 14107	330nF 20-80% 25V
2632	4822 126 14107	330nF 20-80% 25V
2634	3198 016 31020	1nF 25V
2637	4822 126 14107	330nF 20-80% 25V
2639	4822 124 23002	10µF 16V

2640	4822 126 13879	20nF 20-80% 16V
2651	4822 126 14305	100nF 10% 16V
2652	4822 122 33777	47pF 5% 63V
2653	4822 122 32927	20nF 20-80% 50V
2654	4822 126 13881	470pF 5% 50V
2655	4822 126 13881	470pF 5% 50V
2656	4822 126 13881	470pF 5% 50V
2657	4822 126 13881	470pF 5% 50V
2658	4822 126 13881	470pF 5% 50V
2661	4822 122 32927	20nF 20-80% 50V
2662	4822 122 32927	20nF 20-80% 50V
2663	4822 126 13881	470pF 5% 50V
2664	4822 126 13881	470pF 5% 50V
2665	4822 124 12095	100µF 20% 16V
2666	4822 124 12095	100µF 20% 16V
2667	3198 016 33380	3p3F 50V
2668	3198 016 33380	3p3F 50V
2669	4822 124 23002	10µF 16V
2670	4822 126 14305	100nF 10% 16V
2673	3198 016 31020	1nF 25V
2674	3198 016 31020	1nF 25V
2675	4822 124 23002	10µF 16V
2677	2020 021 91554	10µF 20% 16V
2678	2020 021 91554	10µF 20% 16V
2679	4822 126 14305	100nF 10% 16V
2680	2020 021 91554	10µF 20% 16V
2681	4822 126 14305	100nF 10% 16V
2682	2020 021 91554	10µF 20% 16V
2685	3198 016 31020	1nF 25V
2686	3198 016 31020	1nF 25V
2693	4822 126 13883	220pF 5% 50V
2694	4822 126 14305	100nF 10% 16V
2702	2020 021 91554	10µF 20% 16V
2703	4822 126 14305	100nF 10% 16V
2704	2020 021 91554	10µF 20% 16V
2706	2020 021 91557	100µF 20% 16V
2707	4822 126 14305	100nF 10% 16V
2708	2020 021 91554	10µF 20% 16V
2709	4822 126 14305	100nF 10% 16V
2710	2020 021 91554	10µF 20% 16V
2712	2020 021 91554	10µF 20% 16V
2713	4822 126 14305	100nF 10% 16V
2728	4822 126 14305	100nF 10% 16V
2729	4822 126 14225	56pF 5% 50V
2730	4822 126 14494	22nF 10% 25V
2731	4822 122 31765	100pF 2% 63V
2733	4822 126 14494	22nF 10% 25V
2738	4822 126 14494	22nF 10% 25V
2743	4822 126 14494	22nF 10% 25V
2747	4822 126 14507	18pF 5% 50V
2748	4822 126 14507	18pF 5% 50V
2755	4822 126 14305	100nF 10% 16V
2756	4822 126 14305	100nF 10% 16V
2757	2020 021 91554	10µF 20% 16V
2758	4822 126 14305	100nF 10% 16V
2759	4822 126 14305	100nF 10% 16V
2760	4822 126 14305	100nF 10% 16V
2761	4822 126 14305	100nF 10% 16V
2762	4822 126 14305	100nF 10% 16V
2763	4822 126 14305	100nF 10% 16V
2764	4822 126 14305	100nF 10% 16V
2765	4822 126 14305	100nF 10% 16V
2766	4822 126 14305	100nF 10% 16V
2767	4822 126 14305	100nF 10% 16V
2770	4822 126 14305	100nF 10% 16V
2771	4822 126 14305	100nF 10% 16V
2772	4822 126 14305	100nF 10% 16V
2773	3198 016 31020	1nF 25V
2774	4822 126 14305	100nF 10% 16V
2776	4822 126 14305	100nF 10% 16V
2785	4822 126 14305	100nF 10% 16V
2786	4822 126 14305	100nF 10% 16V
2788	4822 126 14305	100nF 10% 16V
2790	4822 126 14305	100nF 10% 16V
2792	4822 126 14305	100nF 10% 16V
2795	4822 126 14305	100nF 10% 16V
2796	4822 126 14305	100nF 10% 16V
2798	3198 016 36810	680pF 25V
2900	5322 126 11582	6n8F 10% 63V
2901	5322 126 11582	6n8F 10% 63V
2902	5322 126 11583	10nF 10% 50V
2903	5322 126 11582	6n8F 10% 63V
2904	5322 126 11582	6n8F 10% 63V
2906	5322 126 11582	6n8F 10% 63V
2908	4822 126 13883	220pF 5% 50V
2909	4822 126 13883	220pF 5% 50V
2910	4822 126 13883	220pF 5% 50V
2911	4822 126 13883	220pF 5% 50V
2912	4822 126 13883	220pF 5% 50V
2913	4822 126 13883	220pF 5% 50V
2914	4822 126 13883	220pF 5% 50V
2915	4822 126 13883	220pF 5% 50V
2916	4822 126 13883	220pF 5% 50V
2917	5322 126 11582	6n8F 10% 63V

3001	4822 051 30472	4k7 5% 0.062W
3002	4822 051 30472	4k7 5% 0.062W
3003	4822 051 30151	150Ω 5% 0.062W
3004	4822 051 30151	150Ω 5% 0.062W
3005	4822 051 30151	150Ω 5% 0.062W
3006	4822 051 30102	1k 5% 0.062W
3007	4822 051 30102	1k 5% 0.062W
3008	4822 051 30103	10k 5% 0.062W
3009	4822 117 12925	47k 1% 0.063W
3010	4822 117 12925	47k 1% 0.063W
3011	4822 051 30103	10k 5% 0.062W
3012	4822 051 30222	2k2 5% 0.062W
3013	4822 051 30103	10k 5% 0.062W
3014	4822 051 30472	4k7 5% 0.062W
3015	4822 051 30474	470k 5% 0.062W
3016	4822 051 30102	1k 5% 0.062W
3017	4822 051 30472	4k7 5% 0.062W
3018	4822 117 13525	24k 1% 0.62W
3019	4822 051 30471	470Ω 5% 0.062W
3026	4822 051 30221	220Ω 5% 0.062W
3027	4822 051 30221	220Ω 5% 0.062W
3028	4822 051 30221	220Ω 5% 0.062W
3029	4822 051 30221	220Ω 5% 0.062W
3030	4822 051 30472	4k7 5% 0.062W
3031	4822 051 30472	4k7 5% 0.062W
3032	4822 051 30472	4k7 5% 0.062W
3033	4822 051 30472	4k7 5% 0.062W
3034	4822 051 30471	470Ω 5% 0.062W
3035	4822 051 30471	470Ω 5% 0.062W
3036	4822 051 30471	470Ω 5% 0.062W
3037	4822 051 30103	10k 5% 0.062W
3038	4822 051 30472	4k7 5% 0.062W
3039	4822 051 30471	470Ω 5% 0.062W
3040	4822 051 30471	470Ω 5% 0.062W
3041	4822 051 30471	470Ω 5% 0.062W
3042	4822 051 30103	10k 5% 0.062W
3043	4822 051 30471	470Ω 5% 0.062W
3044	4822 051 30471	470Ω 5% 0.062W
3045	4822 051 30471	470Ω 5% 0.062W
3049	4822 051 30471	470Ω 5% 0.062W
3050	4822 051 30471	470Ω 5% 0.062W
3051	4822 051 30471	470Ω 5% 0.062W
3052	4822 051 30682	6k8 5% 0.062W
3053	4822 051 30103	10k 5% 0.062W
3055	2422 086 11013	Fuse 1Ω5
3056	4822 117 12925	47k 1% 0.063W
3057	4822 117 12925	47k 1% 0.063W
3059	4822 051 30472	4k7 5% 0.062W
3060	4822 051 30272	2k7 5% 0.062W
3061	4822 051 30103	10k 5% 0.062W
3062	4822 051 30101	100Ω 5% 0.062W
3063	4822 051 30101	100Ω 5% 0.062W
3064	4822 051 30101	100Ω 5% 0.062W
3300	2322 750 63908	Fuse 3Ω9 5%
3301	4822 117 13632	100k 1% 0.62W
3302	2322 750 63908	Fuse 3Ω9 5%
3304	2322 750 63908	Fuse 3Ω9 5%
3306	4822 051 30221	220Ω 5% 0.062W
3307	4822 051 30183	18k 5% 0.062W
3308	4822 051 30684	680k 5% 0.062W
3310	4822 117 12925	47k 1% 0.063W
3311	4822 117 13632	100k 1% 0.62W
3314	4822 051 30103	10k 5% 0.062W
3315	4822 051 30102	1k 5% 0.062W
3316	4822 051 30123	12k 5% 0.062W
3317	4822 051 30221	220Ω 5% 0.062W
3318	4822 051 30102	1k 5% 0.062W
3320	4822 051 30101	100Ω 5% 0.062W
3321	4822 051 30101	100Ω 5% 0.062W
3322	4822 051 10102	1k 2% 0.25W
3324	4822 051 30472	4k7 5% 0.062W
3327	4822 117 13632	100k 1% 0.62W
3328	4822 051 30393	39k 5% 0.062W
3329	4822 117 13568	6Ω8 5% 1206
3330	4822 051 30332	3k3 5% 0.062W
3331	4822 051 30102	1k 5% 0.062W
3333	4822 051 30102	1k 5% 0.062W
3335	4822 051 30332	3k3 5% 0.062W
3336	4822 051 30102	1k 5% 0.062W
3337	4822 051 30153	15k 5% 0.062W
3338	4822 051 30682	6k8 5% 0.062W
3340	4822 051 30101	100Ω 5% 0.062W
3341	4822 051 30101	100Ω 5% 0.062W
3342	4822 051 30101	100Ω 5% 0.062W
3343	4822 051 30683	68k 5% 0.062W
3344	4822 051 30222	2k2 5% 0.062W
3345	4822 051 30103	10k 5% 0.062W
3346	4822 051 30333	33k 5% 0.062W
3347	4822 051 30223	22k 5% 0.062W
3348	4822 051 30222	2k2 5% 0.062W

3351	4822 051 30109	10Ω 5% 0.062W
3352	4822 117 13632	100k 1% 0.62W
3353	4822 051 30102	1k 5% 0.062W
3354	4822 051 30103	10k 5% 0.062W
3355	4822 051 30109	10Ω 5% 0.062W
3356	4822 051 30101	100Ω 5% 0.062W
3358	4822 051 30222	2k2 5% 0.062W
3359	4822 117 13632	100k 1% 0.62W
3360	4822 051 30102	1k 5% 0.062W
3361	4822 051 30151	150Ω 5% 0.062W
3362	4822 051 30103	10k 5% 0.062W
3363	4822 051 30102	1k 5% 0.062W
3364	4822 051 30683	68k 5% 0.062W
3365	4822 051 30472	4k7 5% 0.062W
3366	4822 051 30102	1k 5% 0.062W
3367	4822 051 30102	1k 5% 0.062W
3370	4822 051 30101	100Ω 5% 0.062W
3371	4822 051 30479	47Ω 5% 0.062W
3372	4822 051 30471	470Ω 5% 0.062W
3376	4822 051 30101	100Ω 5% 0.062W
3377	4822 051 30101	100Ω 5% 0.062W
3378	4822 051 30153	15k 5% 0.062W
3382	4822 051 30471	470Ω 5% 0.062W
3384	4822 051 30101	100Ω 5% 0.062W
3385	4822 051 30471	470Ω 5% 0.062W
3386	4822 051 30223	22k 5% 0.062W
3388	4822 051 30681	680Ω 5% 0.062W
3389	4822 117 12925	47k 1% 0.063W
3390	4822 051 30183	18k 5% 0.062W
3391	4822 051 30683	68k 5% 0.062W
3393	4822 117 13632	100k 1% 0.62W
3394	4822 051 30472	4k7 5% 0.062W
3395	4822 051 30222	2k2 5% 0.062W
3400	4822 117 11152	4Ω7 5%
3407	4822 051 30562	5k6 5% 0.063W
3410	4822 051 30472	4k7 5% 0.062W
3411	4822 051 30472	4k7 5% 0.062W
3415	4822 051 30103	10k 5% 0.062W
3416	4822 117 13568	6Ω8 5% 1206
3418	4822 051 30391	390Ω 5% 0.062W
3419	4822 051 30101	100Ω 5% 0.062W
3419	4822 051 30479	47Ω 5% 0.062W
3421	4822 051 30562	5k6 5% 0.063W
3423	4822 051 30562	5k6 5% 0.063W
3433	4822 051 30392	3k9 5% 0.063W
3434	4822 051 30472	4k7 5% 0.062W
3435	4822 051 30562	5k6 5% 0.063W
3436	4822 051 30271	270Ω 5% 0.062W
3437	4822 051 30102	1k 5% 0.062W
3439	4822 051 30471	470Ω 5% 0.062W
3439	4822 051 30561	560Ω 5% 0.062W
3441	4822 051 30393	39k 5% 0.062W
3446	4822 051 30101	100Ω 5% 0.062W
3453	4822 051 30223	22k 5% 0.062W
3530	4822 157 71593	10µH 10%
3532	4822 051 30273	27k 5% 0.062W
3544	4822 117 12864	82k 5% 0.6W
3545	4822 117 12864	82k 5% 0.6W
3550	4822 051 30102	1k 5% 0.062W
3601	4822 117 12864	82k 5% 0.6W
3602	4822 051 30681	680Ω 5% 0.062W
3603	4822 051 30681	680Ω 5% 0.062W
3604	4822 051 30471	470Ω 5% 0.062W
3605	4822 051 30471	470Ω 5% 0.062W
3606	4822 051 30154	150k 5% 0.062W
3610	4822 117 12925	47k 1% 0.063W
3611	4822 117 12925	47k 1% 0.063W
3621	4822 051 30273	27k 5% 0.062W
3624	4822 051 30681	680Ω 5% 0.062W
3625	4822 051 30333	33k 5% 0.062W
3630	4822 051 30273	27k 5% 0.062W
3634	4822 051 30121	120Ω 5% 0.062W
3637	4822 051 30681	680Ω 5% 0.062W
3651	4822 051 30223	22k 5% 0.062W
3652	4822 051 30223	22k 5% 0.062W
3653	4822 051 30682	6k8 5% 0.062W
3654	4822 051 30682	6k8 5% 0.062W
3655	4822 051 30101	100Ω 5% 0.062W
3656	4822 051 30101	100Ω 5% 0.062W
3658	4822 051 30273	27k 5% 0.062W
3660	4822 051 30154	150k 5% 0.062W
3662	4822 051 30271	270Ω 5% 0.062W
3680	4822 051 30271	270Ω 5% 0.062W
3684	4822 051 30682	6k8 5% 0.062W
3685	4822 051 30682	6k8 5% 0.062W
3686	4822 051 30223	22k 5% 0.062W
3687	4822 051 30223	22k 5% 0.062W
3688	4822 051 30682	6k8 5% 0.062W
3689	4822 051 30682	6k8 5% 0.062W
3690	4822 051 30223	22k 5% 0.062W
3691	4822 051 30223	22k 5% 0.062W
3702	4822 117 12139	22Ω 5% 0.062W
3703	4822 051 30101	100Ω 5% 0.062W
3705	4822 051 30101	100Ω 5% 0.062W

3706	4822 051 30109	10Ω 5% 0.062W
3707	4822 051 30392	3k9 5% 0.063W
3708	4822 051 30272	2k7 5% 0.062W
3709	4822 051 30008	Jumper
3711	4822 051 30102	1k 5% 0.062W
3714	4822 117 12139	22Ω 5% 0.062W
3716	4822 051 30472	4k7 5% 0.062W
3717	4822 051 30472	4k7 5% 0.062W
3718	4822 051 30221	220Ω 5% 0.062W
3719	4822 117 13574	1Ω5 5% 1206
3720	4822 117 13574	1Ω5 5% 1206
3725	4822 051 30105	1M 5% 0.062W
3728	4822 051 30101	100Ω 5% 0.062W
3731	4822 051 30101	100Ω 5% 0.062W
3732	4822 051 10102	1k 2% 0.25W
3733	4822 051 30101	100Ω 5% 0.062W
3739	4822 051 30101	100Ω 5% 0.062W
3740	4822 051 30008	Jumper
3741	4822 051 30102	1k 5% 0.062W
3744	4822 051 30102	1k 5% 0.062W
3745	4822 051 30102	1k 5% 0.062W
3746	4822 051 30472	4k7 5% 0.062W
3747	4822 051 30689	68Ω 5% 0.063W
3748	4822 051 30689	68Ω 5% 0.063W
3749	4822 051 30689	68Ω 5% 0.063W
3754	4822 051 30109	10Ω 5% 0.062W
3755	4822 051 30008	Jumper
3757	4822 051 30008	Jumper
3759	4822 051 30008	Jumper
3790	3198 031 11010	4X100Ω 5%
3791	3198 031 11010	4X100Ω 5%
3792	3198 031 11010	4X100Ω 5%
3793	3198 031 11010	4X100Ω 5%
3794	3198 031 11010	4X100Ω 5%
3795	3198 031 11010	4X100Ω 5%
3796	4822 051 30101	100Ω 5% 0.062W
3797	4822 051 30101	100Ω 5% 0.062W

5301	4822 157 11876	6.8µH 10%
5302	4822 157 11876	6.8µH 10%
5401	3198 018 33370	0U33 10%
5401	4822 157 71303	Coil MLF2012DR39KT
5405	3198 018 33980	3U9 10%
5406	4822 157 11876	6.8µH 10%
5407	2422 535 95427	Bead 100mHz
5408	2422 549 44459	IND VAR 78mHz
5409	2422 535 95427	Bead 100mHz
5410	3198 018 51080	1U 10%
5639	4822 157 11781	Coil BLM11A601SPT1
5640	4822 157 11781	Coil BLM11A601SPT1
5641	4822 157 11781	Coil BLM11A601SPT1
5642	4822 157 11781	Coil BLM11A601SPT1
5643	4822 157 11781	Coil BLM11A601SPT1
5644	4822 157 11781	Coil BLM11A601SPT1
5645	4822 157 11781	Coil BLM11A601SPT1
5651	2422 549 43769	100mHz 30R
5652	2422 549 43769	100mHz 30R
5653	2422 549 43769	100mHz 30R
5654	4822 157 11716	Coil BLM21P300SPT
5655	3198 018 56880	6U8 10%
5656	4822 157 71593	10µH 10%
5701	4822 157 71206	Coil
5702	2422 535 95427	Bead 100mHz
5703	4822 157 11716	Coil BLM21P300SPT
5704	4822 157 11716	Coil BLM21P300SPT
5705	2422 535 95427	Bead 100mHz
5706	4822 157 11778	5U6 10%
5707	4822 157 11781	Coil BLM11A601SPT1
5711	4822 157 11781	Coil BLM11A601SPT1
5713	4822 157 11781	Coil BLM11A601SPT1
5718	3198 018 33370	0U33 10%
5720	4822 157 11781	Coil BLM11A601SPT1
5911	4822 157 11781	Coil BLM11A601SPT1
5912	4822 157 11781	Coil BLM11A601SPT1
5913	4822 157 11781	Coil BLM11A601SPT1
5914	4822 157 11781	Coil BLM11A601SPT1
5915	4822 157 11781	Coil BLM11A601SPT1
5916	4822 157 11781	Coil BLM11A601SPT1
5917	4822 157 11781	Coil BLM11A601SPT1
5918	4822 157 11781	Coil BLM11A601SPT1
5919	4822 157 11781	Coil BLM11A601SPT1
5920	4822 157 11781	Coil BLM11A601SPT1
5921	4822 157 11781	Coil BLM11A601SPT1
5922	4822 157 11781	Coil BLM11A601SPT1
5923	4822 157 11781	Coil BLM11A601SPT1
5924	4822 157 11781	Coil BLM11A601SPT1
5925	4822 157 11781	Coil BLM11A601SPT1
5926	4822 157 11781	Coil BLM11A601SPT1
5927	4822 157 11781	Coil BLM11A601SPT1
5928	4822 157 11781	Coil BLM11A601SPT1
5929	4822 157 11781	Coil BLM11A601SPT1
5930	4822 157 11781	Coil BLM11A601SPT1
5931	4822 157 11781	Coil BLM11A601SPT1
5932	4822 157 11781	Coil BLM11A601SPT1
5933	4822 157 11781	Coil BLM11A601SPT1
5935	4822 157 11781	Coil BLM11A601SPT1
5940	4822 157 11781	Coil BLM11A601SPT1
5943	4822 157 11781	Coil BLM11A601SPT1
5944	4822 157 11781	Coil BLM11A601SPT1
5945	4822 157 11781	Coil BLM11A601SPT1
5946	4822 157 11781	Coil BLM11A601SPT1
5947	4822 157 11781	Coil BLM11A601SPT1
5948	4822 157 11781	Coil BLM11A601SPT1
5949	4822 157 11781	Coil BLM11A601SPT1
5950	4822 157 11781	Coil BLM11A601SPT1
5951	4822 157 11781	Coil BLM11A601SPT1

6303	4822 130 11594	BZX284-C47
6304	4822 130 83757	BAS216
6306	9322 129 37685	BZM55-C5V6
6307	4822 130 11528	1PS76SB10
6309	4822 130 83757	BAS216
6310	9322 129 38685	BZM55-C6V8
6311	9322 149 08685	BZM55-C22
6319	4822 130 83757	BAS216
6320	4822 130 83757	BAS216
6321	4822 130 83757	BAS216
6322	4822 130 83757	BAS216
6403	4822 130 11525	1SS356
6404	4822 130 11525	1SS356
6405	4822 130 11525	1SS356
6406	9322 149 08685	BZM55-C22
6652	9322 129 40685	BZM55-C10
6654	4822 130 83757	BAS216

7001	9352 641 92557	SAA5667
7001	9352 659 94557	SAA5647HL/M1
7002	4822 130 60373	BC856B
7003	3198 010 42310	BC847BW
7004	3198 010 42310	BC847BW
7005	9322 116 74668	LD1117D33
7006	4822 209 73852	PMBT2369
7007	4822 209 73852	PMBT2369
7011	9322 156 63668	CY7C1019V33-15VC
7012	4822 209 17377	M24C32-WMN6
7301	9352 625 23518	TDA9330H/N2
7303	5322 130 42756	BC857C
7307	9352 630 99118	Comb filter multi TDA9181
7308	9340 310 30215	PDTC144ET
7309	9340 310 30215	PDTC144ET
7310	9340 310 30215	PDTC144ET
7311	3198 010 42310	BC847BW
7312	3198 010 42310	BC847BW
7313	4822 209 73852	PMBT2369
7314	3198 010 42310	BC847BW
7315	4822 209 73852	PMBT2369
7320	3198 010 42310	BC847BW
7322	3198 010 42310	BC847BW
7323	9352 625 24518	TDA9321H/N2
7324	5322 130 63679	BC847CW
7401	3198 010 42310	BC847BW
7405	3198 010 42310	BC847BW
7406	3198 010 42310	BC847BW
7407	5322 130 42756	BC857C
7411	5322 130 60159	BC846B
7651	9322 151 17671	MSP3411G-FH-A2
7656	9340 425 30115	BC847BPN
7661	9340 425 30115	BC847BPN
7682	9340 425 30115	BC847BPN
7701	5322 130 42756	BC857C
7702	3198 010 42310	BC847BW
7704	4822 209 73852	PMBT2369
7708	4822 209 90034	SAA4990H/V0
7709	9352 640 20557	SAA4978H/V203
7713	9322 116 74668	LD1117D33
7714	4822 209 17307	MSM54V12222A-30JS
7715	4822 209 17307	MSM54V12222A-30JS
7716	2422 486 80737	32P female V
8681	3104 311 00121	3P 280mm
8682	3104 311 02951	10P 280mm

[C] PIP DW Panel

Various

0172	3104 301 08351	Phone 120 phone
0175	3104 304 22073	multi voltage bracket
0200	4822 267 10734	5P
0201	4822 267 10557	10P
0205	2422 025 16587	10P female V
0207	4822 267 10565	4P
0236	4822 267 10735	3P
0272	2422 025 16382	3P male V
0273	2422 025 12482	6P male V
1327	4822 242 10694	Crystal 12MHz
1333	2422 549 44311	Filter 5.8-6.5MHz
1352	2422 549 44202	Saw Filter OFWK6287K
1352	2422 549 44223	Saw Filter OFWK7260M

2261	4822 124 40207	100µF 20% 25V
2262	5322 126 10511	1nF 5% 50V
2265	4822 124 40207	100µF 20% 25V
2269	4822 126 13751	47nF 10% 63V
2301	3198 017 41050	1µF 10V
2302	5322 126 10184	820P 5% 50V 3
2303	5322 126 10223	4n7F 10% 63V
2306	5322 126 11583	10nF 10% 50V
2309	4822 126 14585	100nF 10% 50V
2312	4822 122 33177	10nF 20% 50V
2313	4822 126 14585	100nF 10% 50V
2314	4822 126 14585	100nF 10% 50V
2316	4822 126 14494	22nF 10% 25V
2317	4822 126 13879	20nF 20-80% 16V
2319	4822 126 14305	100nF 10% 16V
2321	5322 126 10465	3.9nF 10% 50V
2322	4822 124 40248	10µF 20% 63V
2324	4822 126 14585	100nF 10% 50V
2327	4822 126 11671	33pF
2328	4822 126 11671	33pF
2331	4822 124 22652	2.2µF 20% 50V
2332	4822 126 14076	220nF 25V
2333	4822 126 14305	100nF 10% 16V
2334	5322 122 32654	22nF 10% 63V
2335	4822 126 14043	1µF 20-80% 16V
2336	5322 126 10184	820P 5% 50V 3
2338	4822 122 33127	2n2F 10% 63V
2342	4822 126 13692	47pF 1% 63V
2345	4822 126 13692	47pF 1% 63V
2348	4822 122 33777	47pF 5% 63V
2349	4822 122 33177	10nF 20% 50V
2350	4822 124 40248	10µF 20% 63V
2351	4822 122 33177	10nF 20% 50V
2354	4822 126 13482	470nF 20-80% 16V
2355	3198 017 41050	1µF 10V
2356	4822 126 13482	470nF 20-80% 16V
2357	5322 122 32448	10pF 5% 63V
2372	5322 126 10223	4n7F 10% 63V
2373	4822 124 21913	1µF 20% 63V
2374	5322 122 32654	22nF 10% 63V
2375	5322 126 10511	1nF 5% 50V
2376	5322 126 10511	1nF 5% 50V
2377	5322 126 10511	1nF 5% 50V
2380	4822 124 40248	10µF 20% 63V
2385	4822 126 13881	470pF 5% 50V
2386	4822 126 13881	470pF 5% 50V
2390	4822 122 33777	47pF 5% 63V
2391	4822 122 31765	100pF 2% 63V
2392	4822 126 14507	18pF 5% 50V
2393	4822 122 31765	100pF 2% 63V
2401	3198 017 41050	1µF 10V
2402	3198 017 41050	1µF 10V
2403	3198 017 41050	1µF 10V
2404	3198 017 41050	1µF 10V
2405	3198 017 41050	1µF 10V
2411	4822 124 40248	10µF 20% 63V
2412	4822 126 13879	20nF 20-80% 16V
2415	4822 126 13879	20nF 20-80% 16V
2431	4822 126 14305	100nF 10% 16V
2432	4822 126 14305	100nF 10% 16V
2434	4822 126 14305	100nF 10% 16V
2436	4822 124 40207	100µF 20% 25V
2811	4822 126 14305	100nF 10% 16V
2812	4822 126 14305	100nF 10% 16V
2813	4822 122 33753	150pF 5% 50V
2814	4822 126 13838	100nF 20-80% 50V
2816	4822 124 40248	10µF 20% 63V
2817	4822 126 13838	100nF 20-80% 50V
2818	4822 126 13838	100nF 20-80% 50V
2819	4822 126 13838	100nF 20-80% 50V
2821	4822 124 40248	10µF 20% 63V
2822	4822 126 13838	100nF 20-80% 50V
2823	4822 126 14305	100nF 10% 16V
2824	4822 126 14305	100nF 10% 16V
2825	5322 122 33538	150pF 2% 63V
2826	4822 126 13838	100nF 20-80% 50V
2827	4822 124 40207	100µF 20% 25V
2828	4822 126 14305	100nF 10% 16V
2829	4822 126 13838	100nF 20-80% 50V
2831	4822 126 14043	1µF 20-80% 16V

2832	4822 126 14043	1µF 20-80% 16V
2833	4822 126 14305	100nF 10% 16V
2834	4822 124 40248	10µF 20% 63V
2836	4822 126 14305	100nF 10% 16V
2837	4822 126 13838	100nF 20-80% 50V
2838	4822 124 40248	10µF 20% 63V
2839	4822 126 13838	100nF 20-80% 50V
2841	4822 124 40248	10µF 20% 63V
2842	4822 122 33753	150pF 5% 50V
2843	4822 126 14305	100nF 10% 16V
2844	4822 126 14305	100nF 10% 16V
2846	4822 126 13838	100nF 20-80% 50V
2847	5322 122 33538	150pF 2% 63V
2848	4822 126 13838	100nF 20-80% 50V
2849	4822 126 13838	100nF 20-80% 50V
2851	4822 124 40248	10µF 20% 63V
2852	4822 126 14585	100nF 10% 50V
2853	4822 124 40248	10µF 20% 63V
2854	4822 126 13838	100nF 20-80% 50V
2856	5322 122 33538	150pF 2% 63V
2857	4822 122 33753	150pF 5% 50V
2861	4822 124 40248	10µF 20% 63V
2862	4822 126 14305	100nF 10% 16V
2863	4822 124 81151	22µF 50V
2864	3198 017 34730	47nF 16V
2866	3198 017 34730	47nF 16V
2867	3198 017 41050	1µF 10V
2868	4822 126 14305	100nF 10% 16V
2869	4822 124 40207	100µF 20% 25V
2871	3198 017 41050	1µF 10V
2872	3198 017 34730	47nF 16V
2873	3198 017 34730	47nF 16V
2874	4822 051 30008	Jumper
2876	4822 051 30008	Jumper
2877	4822 051 30008	Jumper
2878	4822 126 13838	100nF 20-80% 50V
2882	4822 051 20008	Jumper
2883	4822 051 20008	Jumper
2891	5322 122 31647	1nF10% 63V
2892	4822 122 33777	47pF 5% 63V
2893	4822 122 33777	47pF 5% 63V
2894	4822 122 33777	47pF 5% 63V
2895	4822 126 13692	47pF 1% 63V
2896	4822 126 13692	47pF 1% 63V
2897	4822 122 33777	47pF 5% 63V
2898	4822 124 40207	100µF 20% 25V
2899	4822 124 40207	100µF 20% 25V

3263	4822 117 11449	2k2 5% 0.1W
3264	4822 117 10833	10k 1% 0.1W
3267	4822 051 20479	47Ω 5% 0.1W
3268	4822 051 20479	47Ω 5% 0.1W
3270	4822 051 20008	Jumper
3301	4822 051 30102	1k 5% 0.062W
3305	4822 117 12955	2k7 1% 0.1W
3311	4822 051 20273	27k 5% 0.1W
3312	4822 117 10833	10k 1% 0.1W
3315	4822 117 12708	39k 1% 0.1W
3316	4822 051 30681	680Ω 5% 0.062W
3318	4822 051 30101	100Ω 5% 0.062W
3321	4822 051 30103	10k 5% 0.062W
3322	4822 117 12902	8k2 1% 0.063W
3324	4822 051 20391	390Ω 5% 0.1W
3326	5322 117 12487	1k 1% 0.125W
3327	4822 051 30561	560Ω 5% 0.062W
3329	4822 051 20101	100Ω 5% 0.1W
3330	4822 051 20101	100Ω 5% 0.1W
3333	4822 051 30681	680Ω 5% 0.062W
3334	4822 051 30471	470Ω 5% 0.062W
3335	4822 051 20121	120Ω 5% 0.1W
3338	4822 051 20008	Jumper
3339	4822 117 10833	10k 1% 0.1W
3340	4822 051 30222	2k2 5% 0.062W
3341	4822 051 20479	47Ω 5% 0.1W
3344	4822 051 20479	47Ω 5% 0.1W
3345	4822 051 30479	47Ω 5% 0.062W
3346	4822 051 30561	560Ω 5% 0.062W
3348	4822 051 30008	Jumper
3349	4822 051 30479	47Ω 5% 0.062W
3352	4822 051 30222	2k2 5% 0.062W
3353	4822 051 30682	6k8 5% 0.062W
3354	4822 051 30222	2k2 5% 0.062W
3355	4822 051 30273	27k 5% 0.062W
3356	4822 051 30183	18k 5% 0.062W
3370	4822 051 20101	100Ω 5% 0.1W
3371	4822 116 83933	15k 1% 0.1W
3372	4822 051 30008	Jumper
3374	4822 051 30472	4k7 5% 0.062W
3381	4822 051 20101	100Ω 5% 0.1W
3382	4822 051 20101	100Ω 5% 0.1W
3383	4822 051 20101	100Ω 5% 0.1W
3384	4822 051 30103	10k 5% 0.062W
3385	4822 051 30472	4k7 5% 0.062W
3386	4822 051 30103	10k 5% 0.062W
3387	4822 051 30393	39k 5% 0.062W
3388	4822 051 30103	10k 5% 0.062W
3389	4822 051 30472	4k7 5% 0.062W
3390	4822 051 30471	470Ω 5% 0.062W
3401	4822 051 30101	100Ω 5% 0.062W
3402	4822 051 30101	100Ω 5% 0.062W
3403	4822 051 20101	100Ω 5% 0.1W
3404	4822 051 30101	100Ω 5% 0.062W
3405	4822 051 20101	100Ω 5% 0.1W
3411	4822 117 12925	47k 1% 0.063W
3412	4822 117 12925	47k 1% 0.063W
3413	4822 051 30102	1k 5% 0.062W
3414	4822 117 12925	47k 1% 0.063W
3415	4822 117 12925	47k 1% 0.063W
3416	4822 051 30102	1k 5% 0.062W
3431	4822 051 30101	100Ω 5% 0.062W
3432	4822 051 30101	100Ω 5% 0.062W
3437	4822 051 20472	4k7 5% 0.1W
3438	4822 051 30471	470Ω 5% 0.062W
3439	4822 051 20008	Jumper
3440	4822 051 20471	470Ω 5% 0.1W
3441	4822 051 30152	1k5 5% 0.062W
3444	4822 051 20471	470Ω 5% 0.1W
3453	4822 051 30472	4k7 5% 0.062W
3456	4822 051 30472	4k7 5% 0.062W
3457	4822 051 30472	4k7 5% 0.062W
3460	4822 051 30472	4k7 5% 0.062W
3462	4822 052 10228	2Ω2 5% 0.33W
3465	4822 051 20471	470Ω 5% 0.1W
3801	4822 117 11503	220Ω 1% 0.1W
3802	4822 117 10361	680Ω 1% 0.1W
3803	4822 117 11503	220Ω 1% 0.1W
3804	4822 051 30681	680Ω 5% 0.062W
3805	4822 051 30221	220Ω 5% 0.062W
3806	4822 051 30681	680Ω 5% 0.062W
3807	4822 051 30221	220Ω 5% 0.062W
3808	4822 117 10361	680Ω 1% 0.1W
3809	4822 051 30221	220Ω 5% 0.062W
3810	4822 051 30681	680Ω 5% 0.062W
3811	4822 117 11503	220Ω 1% 0.1W
3812	4822 051 30479	47Ω 5% 0.062W
3813	4822 051 30151	150Ω 5% 0.062W
3814	4822 051 30223	22k 5% 0.062W
3816	4822 051 30479	47Ω 5% 0.062W
3817	4822 051 30151	150Ω 5% 0.062W
3818	4822 051 30479	47Ω 5% 0.062W
3821	4822 051 30151	150Ω 5% 0.062W
3823	4822 117 10361	680Ω 1% 0.1W
3825	4822 051 30221	220Ω 5% 0.062W
3826	4822 051 30332	3k3 5% 0.062W
3827	4822 117 12903	1k8 1% 0.063W
3828	4822 051 30221	220Ω 5% 0.062W
3829	4822 051 30221	220Ω 5% 0.062W
3831	4822 051 30221	220Ω 5% 0.062W
3832	4822 051 30393	39k 5% 0.062W
3833	4822 051 30332	3k3 5% 0.062W
3834	4822 117 12903	1k8 1% 0.063W
3836	4822 051 30332	3k3 5% 0.062W
3837	4822 117 12903	1k8 1% 0.063W
3838	4822 051 30393	39k 5% 0.062W
3839	4822 117 11503	220Ω 1% 0.1W
3846	4822 117 11503	220Ω 1% 0.1W
3852	4822 051 30101	100Ω 5% 0.062W
3854	4822 051 30101	100Ω 5% 0.062W
3860	4822 051 30008	Jumper
3862	4822 052 10108	1Ω 5% 0.33W
3863	4822 052 10108	1Ω 5% 0.33W
3866	4822 051 30102	1k 5% 0.062W
3868	4822 117 12903	1k8 1% 0.063W
3869	4822 051 30332	3k3 5% 0.062W
3871	4822 051 30222	2k2 5% 0.062W
3872	4822 051 30471	470Ω 5% 0.062W
3873	4822 051 30152	1k5 5% 0.062W
3874	4822 051 30152	1k5 5% 0.062W
3876	4822 051 20472	4k7 5% 0.1W
3878	4822 051 30102	1k 5% 0.062W
3879	4822 051 30221	220Ω 5% 0.062W
3880	4822 051 30221	220Ω 5% 0.062W
3881	4822 051 30391	390Ω 5% 0.062W
3882	4822 051 30472	4k7 5% 0.062W
3883	4822 051 30332	3k3 5% 0.062W
3884	4822 117 10361	680Ω 1% 0.1W
3886	4822 051 30008	Jumper
3887	4822 051 30008	Jumper
3888	4822 051 30008	Jumper
3889	4822 051 30339	33Ω 5% 0.062W
3890	4822 051 30339	33Ω 5% 0.062W
3891	4822 051 30339	33Ω 5% 0.062W
3892	4822 051 20472	4k7 5% 0.1W
3893	4822 051 30152	1k5 5% 0.062W
3894	4822 051 30222	2k2 5% 0.062W
3895	4822 051 30471	470Ω 5% 0.062W
3896	4822 051 30152	1k5 5% 0.062W
3897	4822 051 30221	220Ω 5% 0.062W
3898	4822 051 30102	1k 5% 0.062W
4xxx	4822 051 10008	0Ω 5% 0.25W
4xxx	4822 051 20008	0Ω 5% 0.25W

5261	4822 157 11778	5U6 10%
5309	4822 157 71334	0.68µH
5332	4822 157 71334	0.68µH
5333	4822 157 71334	0.68µH
5334	4822 157 71334	0.68µH
5349	4822 157 71694	0U82 10%
5350	3198 018 61590	15U 5%
5351	3198 018 61590	15U 5%
5352	4822 157 71334	0.68µH
5816	4822 157 11506	12uF
5818	4822 157 11506	12uF
5827	4822 157 11506	12uF
5834	4822 157 11506	12uF
5839	4822 157 11506	12uF
5848	4822 157 11506	12uF
5849	4822 157 11506	12uF
5851	4822 157 11506	12uF
5853	4822 157 11506	12uF

6301	4822 130 11525	1SS356
6412	4822 130 11397	BAS316
6415	4822 130 11397	BAS316
6801	4822 130 11564	UDZ3.9B
6802	4822 130 11564	UDZ3.9B

7201	2422 542 90075	Tuner TEDE9X700A ALPS
7201	2422 542 90076	TUN SPL V+U PLL IEC Dk
7301	9352 638 73557	TDA8889H/N1
7305	3198 010 42310	BC847BW
7307	3198 010 42310	BC847BW
7331	5322 130 42756	BC857C
7332	3198 010 42310	BC847BW
7385	3198 010 42310	BC847BW
7386	3198 010 42310	BC847BW
7401	5322 209 14481	HEF4053BT
7403	4822 209 17345	M62320FP
7411	3198 010 42310	BC847BW
7412	3198 010 42310	BC847BW
7438	3198 010 42310	BC847BW
7801	9352 639 81557	SAB9081H/N4
7802	4822 209 80591	LM317T
7803	4822 209 12776	TDA8601T/C1
7804	9352 457 50115	74HC1G32GW
7805	3198 010 42310	BC847BW
7806	3198 010 42310	BC847BW
7807	3198 010 42310	BC847BW
7808	3198 010 42310	BC847BW
7809	3198 010 42310	BC847BW
7810	3198 010 42310	BC847BW
7828	3198 010 42310	BC847BW
7871	3198 010 42310	BC847BW
7874	3198 010 42310	BC847BW
7876	5322 130 42756	BC857C
7891	3198 010 42310	BC847BW
7892	3198 010 42310	BC847BW
7893	3198 010 42310	BC847BW
7894	5322 130 42756	BC857C

[D] Side I/O Panel

Various

0044	3139 124 30421	Side I/O bracket
1901	2422 026 04926	4P female H
1902	4822 267 10975	3P
1903	4822 267 31014	Headphone socket
1936	2422 025 12485	11P male V

2903	5322 122 32531	100pF 5% 50V
2904	5322 122 32531	100pF 5% 50V
2905	4822 122 33177	10nF 20% 50V
2906	4822 122 33177	10nF 20% 50V

3901	4822 051 20101	100Ω 5% 0.1W
3902	4822 116 52201	75Ω 5% 0.5W
3903	4822 051 20101	100Ω 5% 0.1W
3904	4822 116 52201	75Ω 5% 0.5W
3905	4822 116 52249	1k8 5% 0.5W
3906	4822 050 11002	1k 1% 0.4W
3908	4822 050 11002	1k 1% 0.4W
3910	4822 116 52276	3k9 5% 0.5W
3911	4822 050 21003	10k 1% 0.6W
3912	4822 050 21003	10k 1% 0.6W
8936	3104 301 07753	11P 560mm

[E] Top Control Panel

Various

0215	4822 267 10748	3P
1091	4822 276 13775	Switch
1092	4822 276 13775	Switch
1093	4822 276 13775	Switch
1094	4822 276 13775	Switch

3091	4822 051 20561	560Ω 5% 0.1W
3092	4822 051 20391	390Ω 5% 0.1W
3093	4822 051 20561	560Ω 5% 0.1W
3094	4822 117 11504	270Ω 1% 0.1W
3095	4822 051 20332	3k3 5% 0.1W
3096	4822 117 11139	1k5 1% 0.1W

6091	4822 130 31983	BAT85
8345	4822 320 12511	3P 1500mm

[G] DC Shift Panel

Various

0317	4822 265 20723	2P
0318	4822 265 20723	2P
1001	3104 328 06231	DC shift assy EMG
1430	2422 086 10581	Fuse 400mA 65V

5430	3128 138 38911	DC shift coil

6432	9340 317 00133	BYD33V
6433	9340 317 00133	BYD33V
8318	3104 301 08731	2P3 220mm

[I] DAF Panel

Various

0030	3104 304 21651	DAF DC-SHIFT BRACKET
0317	4822 265 20723	2P
0318	2422 025 16374	2P male V
0391	3104 311 02452	JST 340mm
0397	4822 267 10973	1P

2800	2222 375 90504	820pF 5% 2kV
2890	2222 375 90504	820pF 5% 2kV

3898	4822 116 21211	VDR 420V
3899	4822 116 21211	VDR 420V

5800	2422 531 02437	TFM SIG DAF S21975-03

[J] Mains Switch Panel

Various

0132▲	4822 276 14024	Power switch
0187▲	3139 124 30431	Front interface bracket
0214	2422 025 06353	5P male H
1002	9322 127 54667	IR receiver TSOP1836UH1
1008▲	9322 050 99682	LED

2001	4822 124 40207	100uF 20% 25V
2002	4822 122 30043	10nF 80% 63V

3003	4822 116 52228	680Ω 5% 0.5W
3004	4822 116 80176	1Ω 5% 0.5W
3008	4822 053 21475	4M7 5% 0.5W
3009	4822 053 21225	2M2 5% 0.5W

[Y] Mains Harmonic Panel

Various

0030	3139 124 33211	Mains harmonic bracket
0061	4822 265 20723	2P

2061	4822 122 33799	1nF 10% 1kV

5066	8204 000 74291	Coil Mains harmonic